**GEORGIA INSTITUTE OF TECHNOLOGY**
OFFICE OF CONTRACT ADMINISTRATION
**SPONSORED PROJECT INITIATION**

Date: 9/6/78

Project Title: Characterizations of Kaolins as Ores of Aluminum

Project No: E-19-668

Project Director: Dr. J. E. Husted

Sponsor: U. S. Department of the Interior, Bureau of Mines

Agreement Period: From 8/17/78 Until 7/16/79
(Contract Period of Performance)

Type Agreement: Contract No. J0188120

Amount: $83,078 (Partially funded at $24,803 for Phase I)

Reports Required: Quarterly Technical Reports, Quarterly Financial Reports, Final Report

Sponsor Contact Person (s):

Technical Matters

Martin H. Stanczyk
Tuscaloosa Metallurgy Res. Ctr.
Box L
University, AL 35486

Contractual Matters
(thru OCA)

John P. Connelly
U.S. Bureau of Mines
Branch of Procurement
2401 E. Street, N.W.
Washington, D.C. 20241
(202) 634-4700

Defense Priority Rating: n/a

Assigned to: Chemical Engineering (School/Laboratory)

COPIES TO:

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- Other

CA-3 (3/76)

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

# SPONSORED PROJECT TERMINATION SHEET

Date 6/30/82

**Project Title:** Characterization of Kaolins as Ores of Aluminum

**Project No:** E-19-668 (Old project, not new one)

**Project Director:** Dr. Husted

**Sponsor:** Bureau of Mines

**Effective Termination Date:** 1/16/80

**Clearance of Accounting Charges:** _____

**Grant/Contract Closeout Actions Remaining:**

- [X] [redacted] Closing Documents
- [ ] Final Fiscal Report
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other _____

**Assigned to:** ChE (School/[redacted])

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GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

September 7, 1978

Mr. Martin H. Stanczyk
U.S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report No. 1
Contract No. J0188120, Georgia Tech Project No. E-19-668
Period: July 1, 1978 - August 30, 1978

Dear Mr. Stanczyk:

During the subject period, 120 clay samples have been collected in a geographical area extending from McDuffie County through Warren, Glascock, Jefferson, Washington, Wilkerson, Baldwin, Jones, and Twiggs Counties. The majority of the samples were from the Wrens mining district (over 70 samples) and were taken for the most part from sample drill holes.

Each sample was located on a 7.5 minute quadrangle map. Surface elevations were determined for each sample as well as thickness of overburden to the sample. An American Paulin System surveying barometer was used for elevations, with elevations tied in to U.S.G.S. bench marks and triangulation stations.

Sincerely.

John E. Husted
Project Director

JEH:chr

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

December 18, 1978

Mr. Martin H. Stanczyk
U.S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Financial Reports 1 and 2
Contract No. J0188120, Georgia Tech Project No. E-19-668
Period: July 1, 1978 through November 30, 1978

Dear Mr. Stanczyk:

Financial reporting on this project is and has been difficult because the contracting has not been in phase with verbally approved work schedules.

Phase I of the proposal was operating on fiscal year 1978 funding with a total of $23,807 for Phase I. $8,288.75 of this amount was approved for expenditure July 1, 1978, through the first week of August, 1978. The remainder funds were finally contracted but did not show up on the August budget printouts and no estimates were made.

Phase II, budgeted at $55,813 from fiscal year 1979 funds was scheduled to start October 1, 1978, and run through March 30, 1979.

Of the above amount, $37,000 has been allocated to the Engineering Experiment Station for analytical work as shown in our proposal. The Engineering Experiment Station has been given project numbers and have started work as shown in the Technical Report No. 2. None of the $55,813 or work charged to this portion of the budget is reflected in our budget printouts, however, because we do not have a signed contract or written authorization.

The amount of expenditures shown below reflect expenditures against Phase I.

| | Spent | Budgeted |
|---|---|---|
| Personal Services | $10,930.66 | $11,984.00 |
| Retirement (at 9.83% of budgeted Personal Services)[2] | 709.65 | 709.00 |
| Materials and Supplies | 635.18 | 500.00 |
| Equipment | 864.78 | 965.00 |
| Travel | 996.07 | 1,500.00 |
| Overhead (76% of total Personal Services)[1] | 8,307.30 | 8,149.00 |
| Total | $22,443.64 | $23,807.00 |

It should be noted that after the proposal was mailed, two increases took place effective July 1, 1978, namely:

1. Federal auditors increased the Overhead rate from 68% to 76%.

2. State of Georgia increased the Retirement rate from 9.35% to 9.83%.

Additional student charges will be charged to Personal Services.

Sincerely,

John E. Husted
Project Director
Professor, Mineral Engineering

JEH:chr

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

December 18, 1978

Mr. Martin H. Stanczyk
U.S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report Number 2
Contract No. J0188120, Georgia Tech Project Number E-19-668
Report Period: September 1, 1978-November 30, 1978

Dear Mr. Stanczyk:

During the subject period, essentially all samples were prepared for analysis, and all samples have been prepared at the date of this report. Samples were prepared as follows:

Three portions from each location sample were treated as follows:

1. One small portion each was bagged from each location sample without further treatment in order not to disturb the crystals to be used for electron microscope studies.

2. The remainder of the sample was ground in a Bleuler mill. This apparatus will grind to minus 325 mesh in 30 seconds. For clays, the mesh size is probably much finer. The ground material from the Bleuler mill was evenly divided, with one portion for wet analysis of phosphorus and fluorine and the other portion for dry analysis, x-ray, etc.

Equipment ordered for the fluorine analysis and promised in September or early October was not delivered until the week following Thanksgiving.

The 1979 fiscal year funding for the portion of the project to be started October 1, 1978, has not been received as of the date of this report. The Bureau of Mines contract office has given verbal assurances that funding will be forthcoming, and we have been told that we may proceed with the work. On the basis of these verbal assurances, funding was allotted to branches of the Engineering Experiment Station to proceed with analysis. Internal clearances to proceed without a contract amendment or additional funds also were time-consuming.

A further complication is that a principal analyst for the wet procedures has had a major operation.

The net result of the above is that approximately 20 samples have been x-rayed and examined with the electron microscope and no wet analyses have been determined.

Georgia Tech officially closes December 23-January 1, inclusive.

A target date for the end of January 1979 for all analyses to be completed is now set.

Sincerely,

John E. Husted
Project Director

JEH:chr

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

February 26, 1979

Mr. Martin H. Stanczyk
U.S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report Number 3, Contract No. J0188120, Georgia Tech Project E-19-668, Report Period: December, 1978 through February, 1979

Dear Mr. Stanczyk:

During the subject period, sample analyses have been completed as follows:

| Method | Number of samples completed |
|---|---|
| Transmission electron microscopy | 50 |
| Scanning electron microscopy | 41 |
| X-ray diffraction | 43 |
| Microprobe element analysis | 5 |
| Emission spectroscopic analysis | 15 |
| Wet chemistry for fluorine | 75 |
| Wet chemistry for phosphorus | 75 |

All thirty elements shown in the emission spectroscope were determined for each of the first five samples. Our contract, however, calls for only eight elements to be so determined. Because the preparation of the samples for the probe detection is a major part of the cost, all 30 elements can be run for an additional $5600 added to the contract for 140 samples ($40.00 each). If we run only eight, we would like the eight preferred to be designated by the Bureau. May we request guidance on this item. A copy of the analysis of the first five is enclosed.

The financial report will be forwarded about mid-March, after receipt of our budget sheet print-outs.

Sincerely,

John E. Husted
Project Director

JEH:chr

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

June 8, 1979

Mr. M.H. Stanczyk
U.S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report No. 4
Contract J0188120, Georgia Tech Project E-19-668
Report Period: March 1, 1979-May 31, 1979

Dear Mr. Stanczyk:

This report will confirm items discussed by telephone on May 31, 1979.

1. Samples have been completed as follows:

| | Number of Samples |
|---|---|
| X-ray diffraction | 105 |
| Transmission electron microscopy (TEM) | 108 |
| Scanning electron microscopy (SEM) | 93 |
| Emission spectroscopy | 50 |
| Quantitative analysis by electron probe | 50 |

2. A program has been developed for plotting sample locations for topographic map overlay.

The laboratory here at Georgia Tech estimates it will take until the end of August to complete the probe quantitative analysis, after which the map plots and contouring will follow as well as a final report.

As you will recall, the contract calls for eight elements to be determined by the probe, and some 30 or more elements showed as detectable. Hence, it was necessary to decide which eight were to be determined in order to stay within the budget. This resulted in considerable time delay.

We are therefore requesting a six-month no-additional-cost time extension. A formal request will also come from our Contract Administration office.

Sincerely,

John E. Husted
Project Director

JEH:chr

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

September 4, 1979

Mr. Martin A. Stanczyk
U. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report Number 5, Contract No. J0188120
Georgia Tech Project E-19-668
Report Period: June through August 1979

Dear Mr. Stancyzk:

As of August 31 all analyses had been completed excepting 23 fluorine and phosphorus determinations. A computer program to print sample locations on a scale of 1/250,000 has been completed. Print outs will be used as overlays on the Athens 1/250,000 topographic sheet. Analyses data will be shown for sample locations and an isoplething program will be iniated.

An extension of the Project until January 31, 1980 with an addition of approximately $7,000 has been requested and verbally approved by Mr. Kirby.

Sincerely,

John E. Husted
Project Director

JEH/kls

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

December 3, 1979

Mr. Martin A. Stanczyk
U. S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report Number 6, Contract No. J0188120
Georgia Tech Project E-19-668
Report Period September through November 1979.

Dear Mr. Stanczyk:

Enclosed please find the following data collections:

1. Computer print out on CalComp plotter on scale of 1/250,000 of locations of samples for Athens and Macon quadrangles.

2. Table showing latitude, longitude, northing, easterling, 1/250,000 quadrangle name, 1/24,000 quadrangle name, county, surface elevation, thickness of overburden, and ore thickness for total samples collected.

3. Table showing phosphorus, and fluorine content of samples 1-77 and other selected samples to total 100 in all.

4. Table showing phosphorus as $P_2O_5$ values for above.

5. Table showing elements determined by emission spectrograph.

6. Table showing elements determined by electron probe. These elemental results are being calculated as oxides and re-tabled.

7. Table showing minerals determined by x-ray diffraction for most samples.

In addition, scanning electron microscope and transmission electron microscope photographs (one each) for samples in excess of the contracted 100 have been mounted and ready for reproduction in the final report.

The first 77 samples were from the Wrens area and represent a continuous Kaolin body. This body will be contoured and isoplethed by the CalComp Plotter.

It will be recalled that the contract called for 100 samples. 120 sample locations were visited and in some instances several samples were taken from the same location, but at different depths of the ore body. Budget restrictions required that selection of samples be made to stay within money allocated. For phosphorus and fluorine 100 samples was strictly adhered to, with all samples of the Wrens area being determined and with selections from other areas being reasonably represented. The emphasis on the Wrens area is that it is where samples for the Boulder City Nev. testing have been taken and where most of the primary aluminum companies have reserves. It also represents some 3.5 billion tons of reserves.

Sincerely,

John E. Husted
Project Director

JEH/sm
Enclosure

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

March 24, 1980

Mr. Martin A. Stanczyk
U. S. Bureau of Mines
Post Office Box L
University, Alabama 35486

Subject: Quarterly Technical Report Number 7, Contract No. J0188120
Georgia Tech Project E-19-668 - Report Period December 1979
through February 1980

Dear Mr. Stanczyk:

All technical data required under the Contract is complete. Copies of data were given to Mr. Stevens at the annual AIME meeting in late February at Las Vegas, Nevada.

Work is underway to furnish data in the format of an Information Circular.

Sincerely,

John E. Husted
Project Director

JEH/sm

E-19-668

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

MEMORANDUM

TO: J. W. Dees

FROM: John E. Husted JEH

DATE: May 8, 1981

SUBJECT: Project E-19-668 Final Report

This report was due January 1980, but the laboratory information being developed by EES was delayed and information was some six weeks to 2 months late. Consequently I could not write the report as budgeted and scheduled. By the time I received the information the following events transpired which effectively prevented the report. All information maps , and data however were mailed to the U.S. Bureau Mines laboratory as soon as received.

Events were as follows:

1. January 17, 1980 I was appointed Director, Georgia Mining and Mineral Resources Institute by Dr. Pettit. This did and does take a large amount of my time (50-75%).

2. February I had gout induced by medication my doctor prescribed. This lasted into the Spring Quarter.

3. The Spring Quarter I taught 2 Courses plus GMMRI plus coordinator Coal research negotiations with both Auburn University and the University of Alabama.

4. My mother had terminal Cancer and died July 12. She lived in Virginia. As soon as classes were over on June 1 went to see my mother. After her death there were various estate matters to settle.

5. As part of my GMMRI responsibility I visited 37 mineral producers in Georgia during the remaining summer.

6. On September 17 I fell and severely injured my left shoulder. This resulted in 3 weeks in hospitals, a major operation, and being away from work until November 17 and then working on only a part time basis until the Winter Quarter, 1981.

7. In December I relayed the above to the U.S. Bureau of Mines. They suggested I apply for more money to complete the project. This I did in the amount of $6,000. This has not been heard from. I also told them that my schedule did not permit Completion until after school in June and at that time I would complete the report with or without an additional $6,000.

Thats ~~were~~ where report E-19-668 stands now.

JEH/llc
5/9/81 - xc: PAD for Project File
PPC

A mining research contract report

SEPTEMBER 1983

# CHARACTERIZATION OF GEORGIA KAOLINS AS ORES OF ALUMINUM

Contract JO-188120
Georgia Institute of Technology

BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

A mining research contract report

SEPTEMBER 1983

# CHARACTERIZATION OF GEORGIA KAOLINS AS ORES OF ALUMINUM

By

JOHN E. HUSTED

Contract JO-188120
Georgia Institute of Technology

BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

50272-101

| REPORT DOCUMENTATION PAGE | 1. REPORT NO. | 2. | 3. Recipient's Accession No. |
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| 4. Title and Subtitle: Characterization of Georgia Kaolins as Ores of Aluminum | | | 5. Report Date: September 1983<br>6. |
| 7. Author(s): John E. Husted | | | 8. Performing Organization Rept. No.: E19-668 |
| 9. Performing Organization Name and Address: School of Chemical Engineering<br>Georgia Institute of Technology<br>Atlanta, Georgia 30332 | | | 10. Project/Task/Work Unit No.<br>11. Contract(C) or Grant(G) No.<br>(C) J0188120<br>(G) |
| 12. Sponsoring Organization Name and Address: U. S. Bureau of Mines<br>2401 E Street, N.W.<br>Washington, D. C. 20241 | | | 13. Type of Report & Period Covered: Final Report 8/17/78-1/16/80<br>14. |

15. Supplementary Notes

16. Abstract (Limit: 200 words)

Quantities of kaolin in Georgia in contiguous or single bodies had been established by previous work to be sufficient for an alumina industry. The need for characterization of this kaolin to determine its suitability as an ore of aluminum resulted in the studies described herein.

It was determined in an area roughly 7 x 27 miles, known as the Wrens district, that approximately 5.9 billion short tons of kaolin averaging 35.55 percent $Al_2O_3$ exist in an essentially continuous clay body. The Macon-Sandersville district consists of discontinuous kaolin bodies averaging 35.28 percent $Al_2O_3$ with an average thickness of 28 feet. Tonnages for this district are not available.

One hundred and twenty core samples of kaolin were analyzed for $K_2O$, CaO, MgO, $Al_2O_3$, $TiO_2$, $Cr_2O_3$, $Fe_2O_3$, $SiO_2$, $P_2O_5$, and F. The $P_2O_5$ and F were analyzed by wet chemistry methods and the others by electron microprobe. Seventy-nine of the samples were from the Wrens district, forty from the Sandersville-Macon district and one from the Andersonville district. Emission spectroscopic analyses were also made to qualitatively determine all elements present for each core. X-ray diffraction studies were made of each core to determine mineral species present. Scanning and transmission electron microscope pictures also are given for each core sample. Elevations, overburden thickness, and kaolin thickness are given for each core site as well as map locations. Isopachs for overburden and kaolin thickness are given for the Wrens district.

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

| 18. Availability Statement | 19. Security Class (This Report) | 21. No. of Pages |
|---|---|---|
| | 20. Security Class (This Page) | 22. Price |

# FOREWORD

This report was prepared by the Georgia Institute of Technology, School of Chemical Engineering, Atlanta, Georgia under the Minerals and Materials Research Program. It was administered under the technical direction of the Tuscaloosa Metallurgy Research Center with Martin A. Stanczyk acting as Technical Project Officer. John P. Connelly was the contract administrator for the Bureau of Mines. This report is a summary of the work recently completed as a part of this contract during the period August 17, 1978 to January 16, 1980. This report was submitted by the authors on September 1983.

We gratefully acknowledge the donation of cores from kaolin producing companies, without which the project could not have been done. We particularly wish to acknowledge Thiele Kaolin Company from whom 77 of the Wrens area cores were obtained as well as some from the Sandersville-Macon area. Other companies include Georgia Kaolin Company (including Yara Engineering Co.), J. M. Huber Corporation, Angelo American Clays Corporation, Engelhard Corporation, M and M Clays, Inc., Griffin Pipe Company, Freeport Kaolin Company, and Reynolds Metal Company.

Acknowledgment is also made to Mrs. Atkins for her excellent help in assembling the tables and other data. Other members of the Georgia Tech staff and their work are acknowledged as follows:

Robert Bell, who as a graduate student located the core sites and determined the elevations.

John L. Brown, Engineering Experiment Station, transmission electron microscope.

James W. Johnson, Engineering Experiment Station, x-ray diffraction, microprobe analysis, and emission spectroscope.

K. D. Logan, Engineering Experiment Station, x-ray diffraction and scanning electron microscope.

Lewis W. Elson and David R. Hurst, Engineering Experiment Station, phosphorus and fluorine determinations.

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## Introduction

Georgia kaolins have been known for over eighty years. A report in 1898 by George Ladd[1] was among the earliest, if not the earliest report. Kaolins have traditionally been sought and used for various ceramic applications, as fillers, and for paper coating. The potential as an ore of aluminum is a relatively recent development.

In 1959 the author made a preliminary study of kaolin reserves in Georgia and estimated an order of magnitude of 500 million short tons for the Macon-Sandersville area.

During the 1960's a unique body of kaolin was found in Jefferson, Glascock, Warren, and McDuffie counties in the northeast center of the state just south of the Fall Line. The geologic strike of the body is northeast with a relatively gentle dip to the southeast. The uniqueness of the body is in its size and purity. Preliminary estimates were that the body was five by twenty miles with an average thickness of thirty to thirty-five feet and contained an order of magnitude of three billion short tons. This discovery is now known as the Wrens district. Two companies are reported to have discovered the body at essentially the same time, but they maintained a proprietary silence regarding the discovery. Later other kaolin companies and at least one aluminum company obtained reserves in the Wrens district. Because of the proprietary nature of the discovery, most of the aluminum industry were not aware of the large reserves of kaolin until September of 1970 when Georgia Tech convened a meeting of the representatives of the kaolin industry, federal and state governments, and the primary aluminum industry.

Prior to the discovery of the Wrens district, kaolin as a source of aluminum has not been considered viable for the state of Georgia. Following the 1970 Georgia Tech meeting a new interest in the potential of kaolin and other non-bauxite sources of aluminum was evidenced by cooperative agreement in 1973 with the U. S. Bureau of Mines and members of the primary aluminum industry to investigate non-bauxite sources of aluminum. The number of companies varied during the course of the agreement, reaching a maximum of ten companies.

One hundred million short tons of clay is considered to be the minimum reserve to be of interest to an aluminum company. Several companies, however, would prefer five hundred million short tons. A study made by Georgia Tech, Contract S-0122100, for the U. S. Bureau

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[1]George E. Ladd, 1898, *A Preliminary Report on Part of the Clays of Georgia*, Ga. Geol. Surv., Bull. 6-A, 204 pp.

of Mines of nonbauxite sources of aluminum in the United States established that there were only three other areas in the continental United States in which these amounts of clays were known to be present and none were in a single or contiguous body within suitable transportation distance of any plant that might be built. The largest of these bodies is an under clay to a coal seam in a band two by one hundred and sixty-five miles long with an average of only twenty percent alumina. Results of this work were reported, with the permission of the U. S. Bureau of Mines, in a paper given at the annual meeting of The Metallurgical Society-AIME in 1974.[2]

A total of 120 samples of kaolin cores in the Wrens and Macon-Sandersville area were examined and characterized as ores of aluminum for this report. A total of seventy-nine of these samples were taken from the Wrens area.

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[2]John E. Husted, 1974, *Potential Reserves of Domestic Non-Bauxite Sources of Aluminum*, TMS-AIME Paper No. A74-65, pp. 691-711.

## Methodology

The Wrens kaolin body is a single clay body believed to be of Ecocene age. This clay body has been extensively drilled by kaolin producing companies on sometimes as close as one hundred foot centers. Agreements were reached with kaolin companies to provide us with samples derived from cores where they had made duplicate cores and could spare the material from their core library. The cores that were taken went to a maximum of one hundred and seventy feet of overburden. The kaolin extends down dip to where several thousand feet of overburden are found, but since the foreseeable mining would be within one hundred and seventy feet of overburden and rather extensive tonnage was found within this area, samples were restricted accordingly. Water wells drilled to basement rock some five to ten miles south of the sample area and some several thousand feet of depth have revealed kaolin just over the basement. The northern side of the kaolin belt, however, pinches out at or near the Fall Line.

The location of each core taken was carefully plotted on a topographic map and from such location latitude and longitude and easting and northing coordinates were determined. Elevations were taken using an American Paulin system, Model MDM-5, Surveying Microaltimeter (aneroid barometer), which was carefully calibrated before and after going to the hole location on a U.S.G.S. bench mark closest to the hole or to other established elevations such as those determined by railroads or the state highway department. Overburden thicknesses and thickness of the kaolin body were determined from measurements made by the individual kaolin companies who did the drilling.

The samples that were taken by the individual companies were taken to their core laboratories where they were split and a section was obtained from the split for the Georgia Tech study. The samples of kaolin obtained by Georgia Tech were wrapped and kept in plastic bags to prevent moisture loss and brought back in to Georgia Tech where they were turned over to the Engineering Experiment Station for the various analytical techniques to be applied.

Eight elements were determined using a MH-64 electron probe microanalyzer. The sensitivity of this instrument for the elements analyzed was on an order of 0.01 percent. The following elemental determinations were made with the microanalyzer: potassium, calcium, magnesium, aluminum, silicon, titanium, chromium, and iron. In addition, phosphorus and fluorine were determined by wet chemical methods, with the phosphorus being accurate to parts per million and the fluorine method to one part in ten thousand. It was known that more than the ten elements were present in the kaolins. Hence, in order to know what elements were present spectrographic qualitative analysis was also made

of the clays using an ARL-Quantometer spectroscope. Mineral species present in the clay were determined using a Phillips x-ray diffractometer. In the electron microscope work a Phillips AM-200 transmission microscope was used and for microscope scanning a Cambridge stereo-scan electron microscope was used. The use of electron microscopes is a standard procedure in characterizing clay samples by the clay industry as is noted under Appendix 2 on the appendix title page.

## Summary of Results

This section of the report will give tables and maps summarizing the data found. Detailed information for each of the holes is found in a series of tables in the Appendix.

Figure 1 shows a map of the Wrens district taken from the Athens, Georgia 1:250,000 Series, revised 1965, preliminary edition February 15, 1980. This map shows the general distribution of the location of the cores which were taken in the Wrens district. Because the Wrens district is a continuous clay body, it was possible to isopach the area both for overburden and for clay thickness. Figure 2 shows an isopach map of the Wrens area giving the thickness of the overburden, whereas Figure 3 is an isopach map of the kaolin thickness in the same Wrens area. All isopaching was done with a Calcomp Plotter. Figure 4 is a sample distribution map of the Sandersville area. This area was not isopached because the bodies of clay are not continuous and they are found in various lenses throughout the area. Insufficient control was available to properly isopach this area. Table 1 gives averages of the overburden in the Wrens district and Table 2 gives the averages, minimum and maximum, areal extent and calculated short tons of the Wrens kaolin body.

It is estimated that the Wrens kaolin deposit averages 25 feet thick over an area 7 x 27 miles (189 square miles) and contains 5.9 billion short tons of kaolin averaging 35.55 percent $Al_2O_3$.

Tables 3 and 4 are the ten elements which were determined by the various clay samples. The tables of data summarize the information and are given in alphabetical order of the elements. For each district the number of samples which were used in the averaging, the maximum elemental value, the minimum elemental value, and a weight average is given for each element determined. The phosphorus and fluorine amounts reflect the greater sensitivity of the methods used for these elements.

As noted previously, details of each hole are summarized in the Appendices.

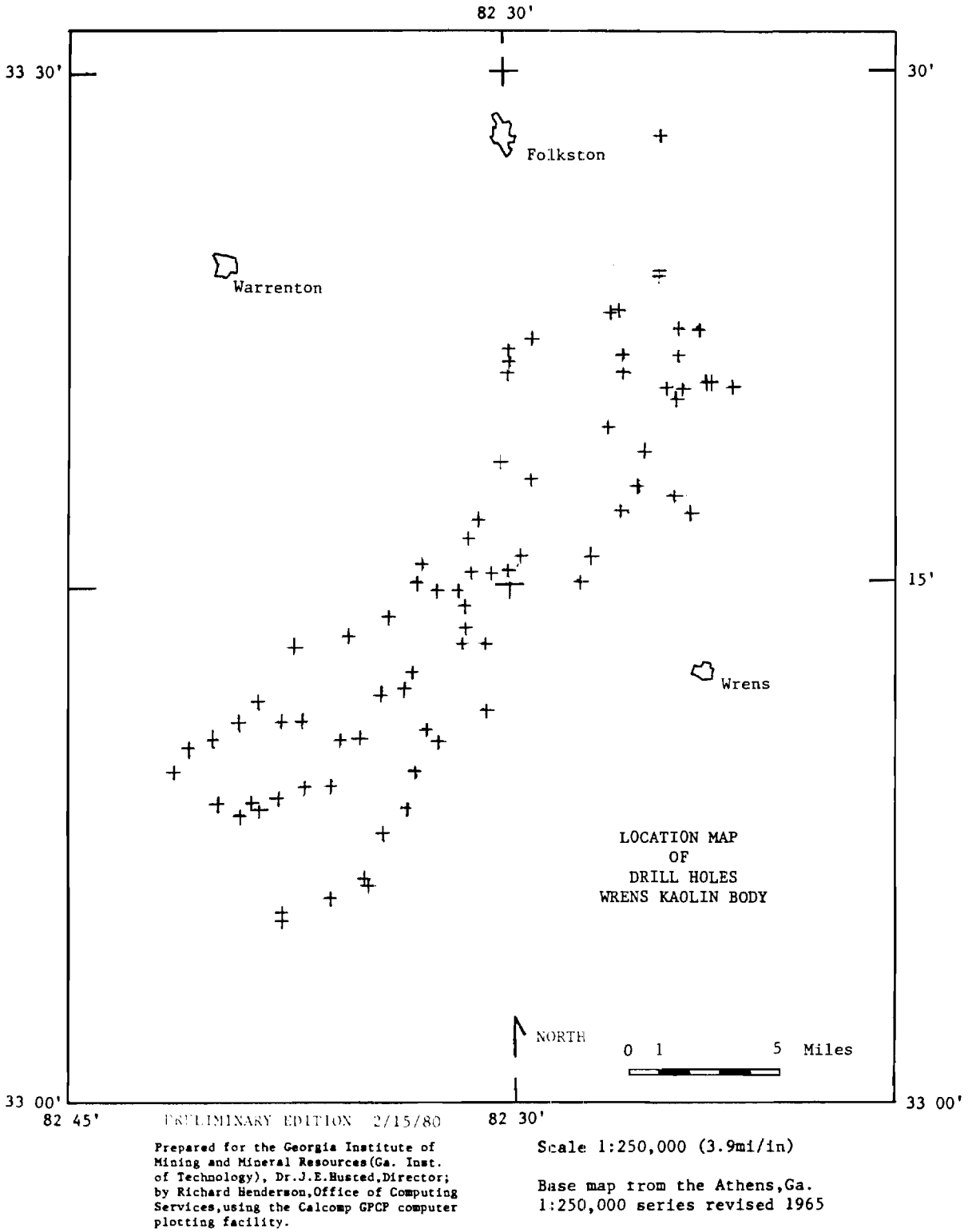



Figure 1. Location Map of the General Distribution of the Cores in the Wrens District.

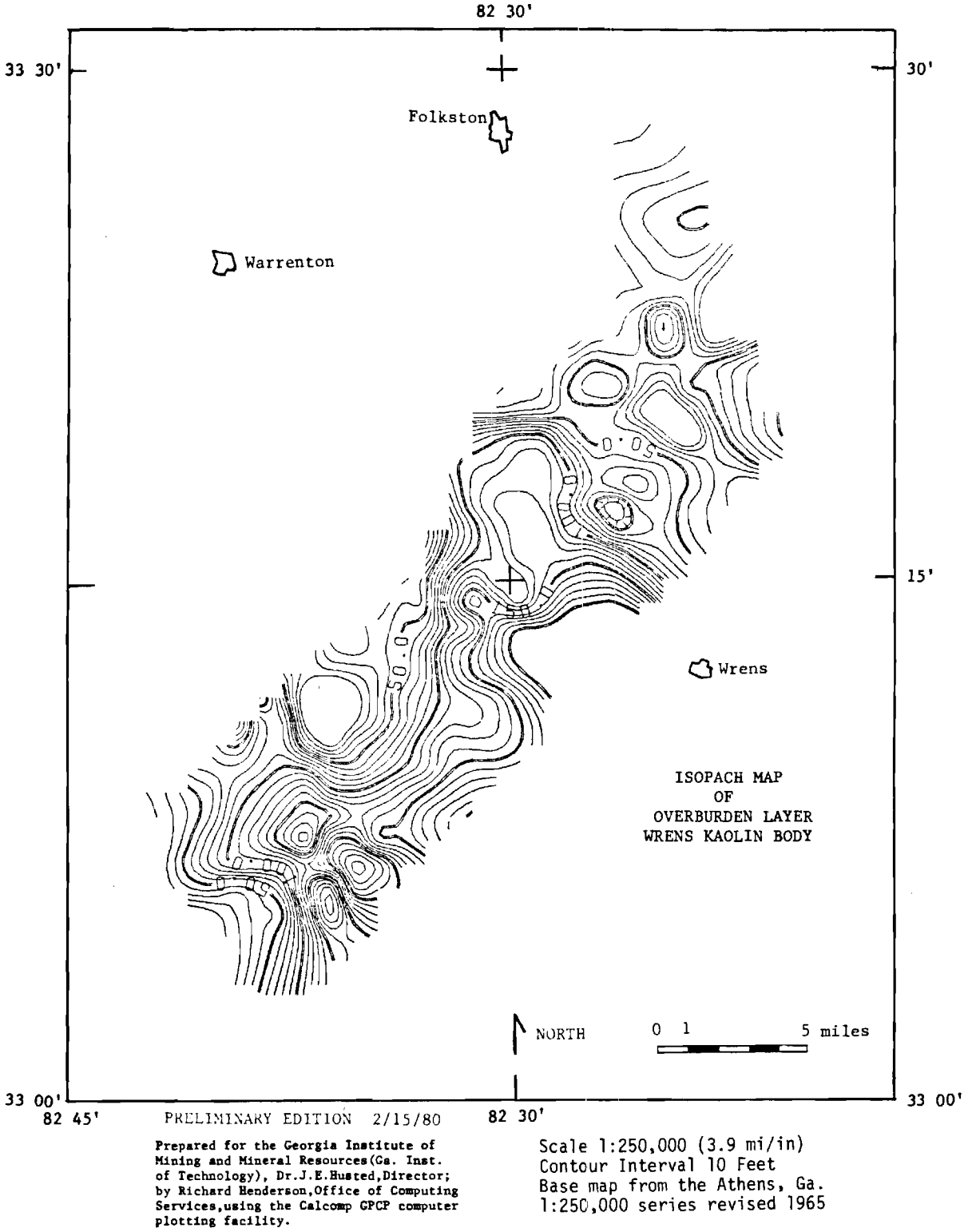



Figure 2. Isopach Map of the Overburden Layer of the Kaolin Body in the Wrens District.

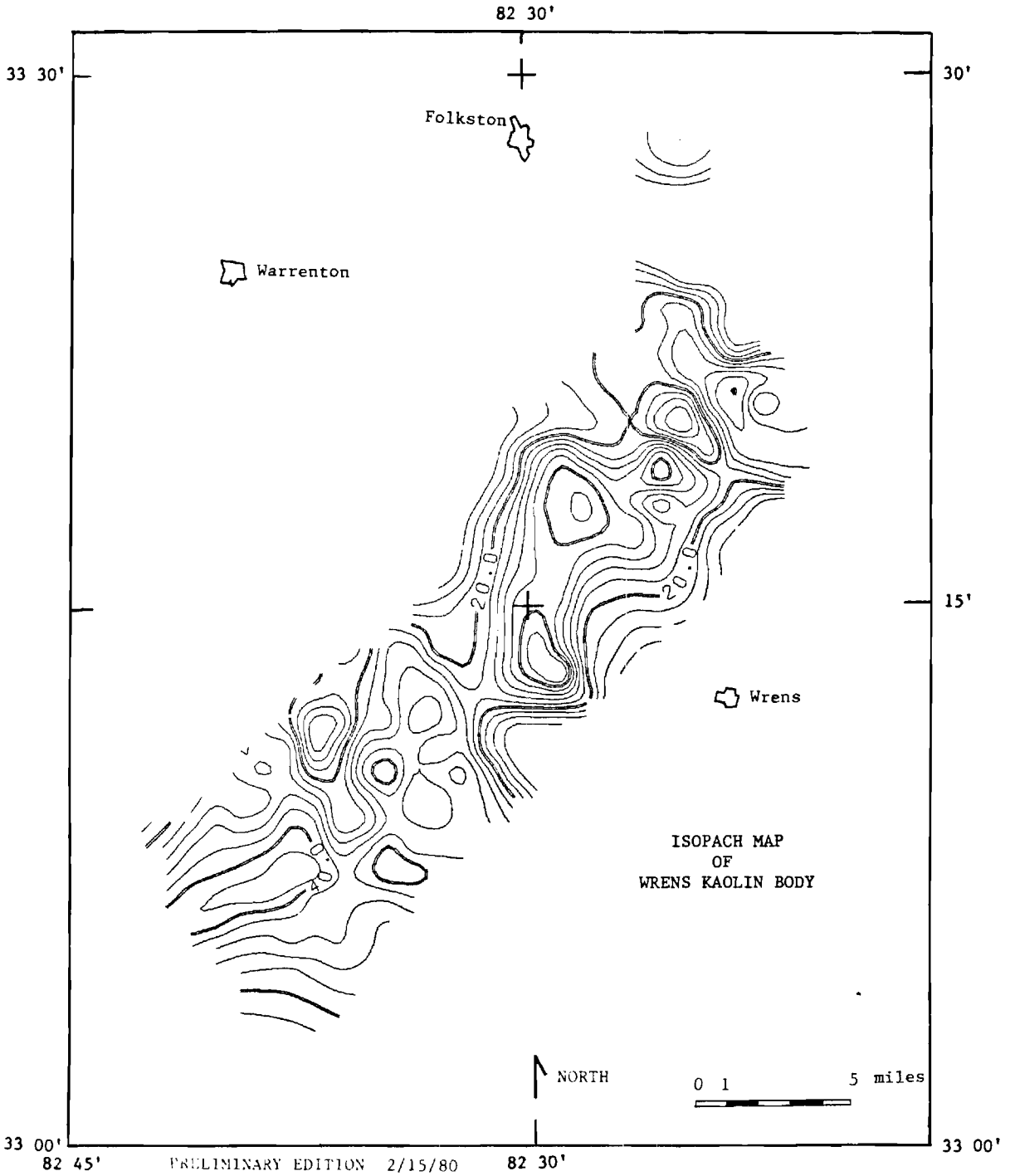



Figure 3. Isopach Map of the Kaolin Thickness in the Wrens District.

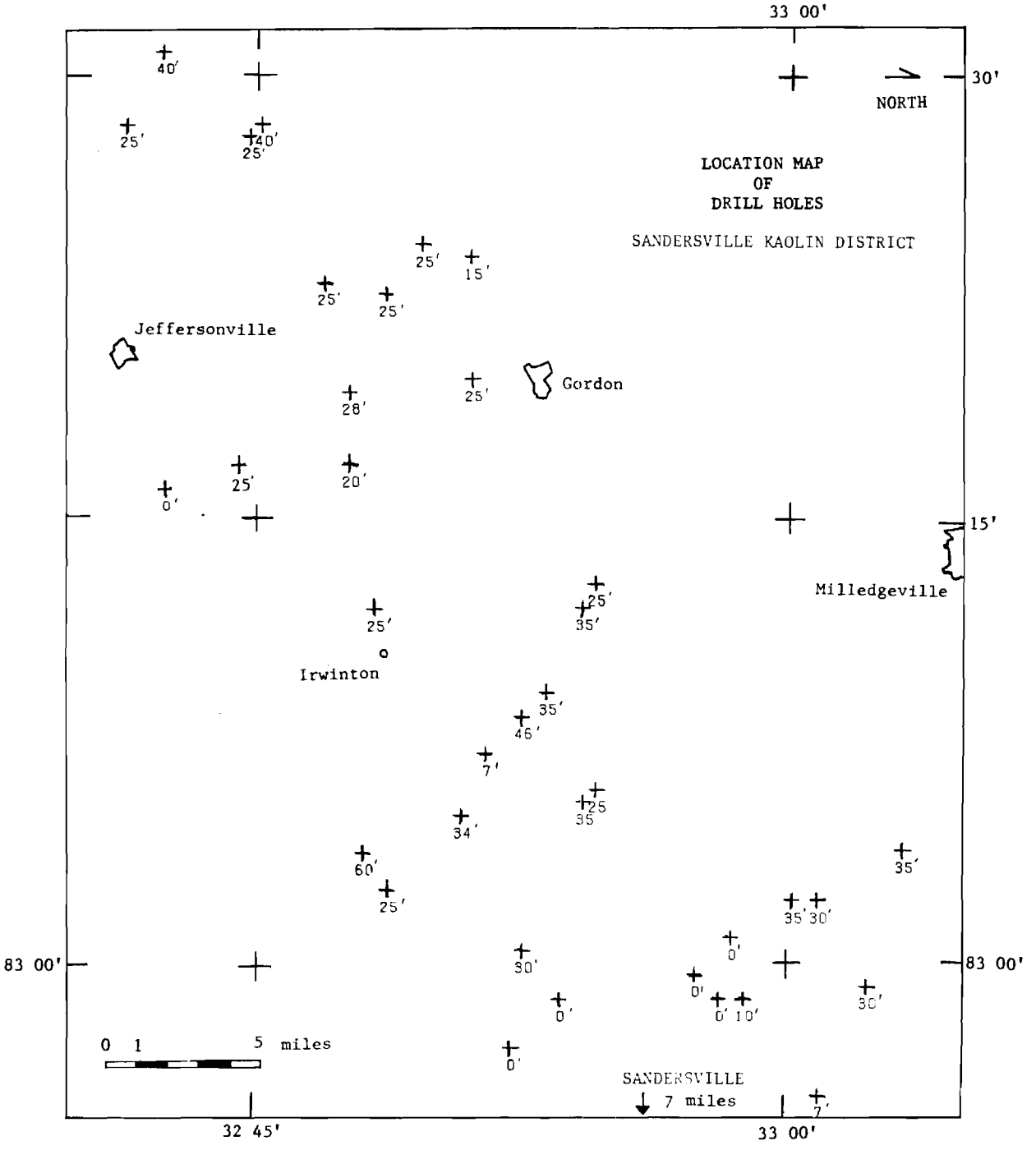



Figure 4. Location Map of the General Distribution of the Cores in the Sandersville Area.

Table 1. Averages of the overburden in the Wrens district

| | |
|---|---|
| Minimum Drilled | 1 Foot |
| Maximum Drilled | 170 Feet |
| Average Drilled | 71 Feet |
| Number of Holes | 79 |

Table 2. Averages, minimum and maximum, areal extent and calculated short tons of the Wrens kaolin body

| | |
|---|---|
| Minimum Drilled Thickness | 5 Feet |
| Maximum Drilled Thickness | 44 Feet |
| Average Drilled Thickness | 25 Feet |
| Areal Extent | 7 x 27 Miles |
| Calculated Short Tons | 5.9 Billion |

Table 3. Summary of chemical analyses of core from the Wrens district

| | Number of Samples | High* (%) | Low* (%) | Average* (%) |
|---|---|---|---|---|
| $Al_2O_3$ | 79 | 38.92 | 33.27 | 35.55 |
| CaO | 78 | 3.02 | 0.01 | 0.31 |
| $Cr_2O_3$ | 78 | 1.18 | 0.07 | 0.06 |
| Fluorine | 77 | 0.0137 | 0.0018 | 0.0051 |
| $Fe_2O_3$ | 79 | 2.70 | 0.41 | 0.95 |
| MgO | 79 | 1.72 | 0.11 | 0.45 |
| $P_2O_5$ | 77 | 0.28642 | 0.00046 | 0.02515 |
| $K_2O$ | 79 | 0.95 | 0.05 | 0.35 |
| $SiO_2$ | 79 | 52.88 | 43.81 | 47.91 |
| $TiO_2$ | 79 | 3.27 | 0.47 | 1.26 |

*Significant figures in accordance with accuracy of method used.

Table 4. Summary of chemical analyses of core from the Macon-Sandersville district

| | Number of Samples | High* (%) | Low* (%) | Average* (%) |
|---|---|---|---|---|
| $Al_2O_3$ | 36 | 36.58 | 32.80 | 35.28 |
| CaO | 38 | 1.39 | 0.03 | 0.23 |
| $Cr_2O_3$ | 37 | 1.05 | 0.02 | 0.12 |
| Fluorine | 22 | 0.0282 | 0.0010 | 0.0124 |
| $Fe_2O_3$ | 37 | 8.51 | 0.41 | 1.16 |
| MgO | 36 | 1.56 | 0.12 | 0.73 |
| $P_2O_5$ | 22 | 0.00687 | 0.00229 | 0.00271 |
| $K_2O$ | 37 | 1.06 | 0.06 | 0.26 |
| $SiO_2$ | 37 | 53.29 | 46.17 | 48.95 |
| $TiO_2$ | 36 | 2.25 | 0.71 | 1.24 |

*Significant figures in accordance with accuracy of method used.

## Discussion of the Results

The purpose of this study was to characterize Georgia kaolin as a potential ore of aluminum. In any consideration of ores quantity and grade or tenor are major factors.

First, concerning quantity, 100 million short tons of reserve have been considered adequate by some companies with 500 million short tons being the maximum needed for an alumina plant of one million short tons per year. The Wrens district alone has an estimated 5.9 billion tons from zero to 180 feet of depth. The kaolin body is known to extend down dip for possibly 10 or more miles, so that the resource estimate in the Wrens area could be larger.

Tonnage in the Macon-Sandersville district was not estimated because of insufficient control for this report. Oral reports from industry geologists, however, were that 12-15 or more billion short tons of kaolin exist in the area from south of Macon to the Savannah River. Their reports were based on their drilling programs. Suffice it to say quantity of kaolin in Georgia in single or contiguous bodies is more than sufficient to be considered as an ore of aluminum.

Kaolinite [$Al_4Si_4O_{10}(OH)_8$], the principal mineral of kaolin, is a two cation compound with water of crystallization and a theoretical alumina composition of 39.5 percent $Al_2O_3$. The kaolins analyzed for this report average a little over 35 percent $Al_2O_3$, with the chief impurity being $TiO_2$, with iron and the alkali metals (Mg, K, and Ca) being next. Phosphorus did not exceed 0.3 percent with an average of less than 0.03 percent.

## Conclusions

The conclusion reached from the above information is that kaolin represents a valid potential source of aluminum for the United States. The estimate of 5.9 billion short tons of kaolin reserves is for the Wrens district alone. Without the additional tonnage of the Macon-Sandersville district, the 5.9 billion short tons of the Wrens area alone constitutes an enormous aluminum ore reserve. Such a reserve would be free from the strategic logistics of ocean transport of aluminum from foreign sources. Such a domestic reserve, therefore, stands as a valuable domestic resource. Further, should this be developed, it would be an offsetting source of income that would negate some of the balance of payments we are now putting forth to other countries and other areas of the world for the aluminum which we use in this country.

The fact remains, however, that we do not have an aluminum from kaolin industry. At this point it is difficult to assess the future as to when such a facility will first be undertaken.

## Appendices

Appendix 1 is a location index of where the cores were obtained and includes elevation data and thickness of overburden and of kaolin beds.

Appendix 2 gives pertinent data for each core in one place. Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM) photographs are included as these are standards for the clay industry in characterization of clays. It will be noted that TEM magnifications are significantly higher than those of SEM. TEM gives more accurate particle sizes and identification in the one-half micron and smaller sizes of non-kaolin clay minerals such as montmorillonite, illite, and other tri-layered type clays and for kaolins which also fall in this size range. SEM gives three dimensions and morphological details and is particularly useful for data concerning kaolins greater than one micron in size. In addition, spatial data and the 10 element analyses are given in the facing page to the TEM and SEM photographs.

Appendix 3 - The purpose of Appendix 3 is to cross reference the chemical analyses to facilitate ease of checking and comparing chemical content of the cores.

Appendix 4 - Determinations of mineral species present in each core using x-ray diffraction techniques.

Appendix 5 - Qualitative determinations of total elements present in each core using Emission Spectroscopic techniques.

# Appendix 1

## Index of Location and Spatial Data of Each Core

## LOCATION OF SAMPLES

IN FEET

| Sample # | Latitude | | | Longitude | | | Northing | Easting | 1/250,000 Quadrangle | 1/24,000 Quadrangle | County | Surface Elevation | Overburden Thickness | Ore Thickness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | o | ' | " | o | ' | " | | | | | | | | |
| 1 | 33 | 15 | 05 | 82 | 27 | 23 | 3679920 | 364220 | Athens | Bowdens Pond | Jefferson | 492 | 170 | 20 |
| 2 | 33 | 21 | 25 | 82 | 26 | 01 | 3691560 | 366620 | " | " | McDuffie | 451 | 33 | 22 |
| 3 | 33 | 20 | 39 | 82 | 24 | 27 | 3690110 | 369030 | " | " | " | 387 | 12 | 11 |
| 4 | 33 | 22 | 09 | 82 | 23 | 20 | 3692840 | 370800 | " | " | " | 386 | 5 | 10 |
| 5 | 33 | 21 | 28 | 82 | 24 | 02 | 3691660 | 369270 | " | " | " | 428 | 42 | 32 |
| 6 | 33 | 10 | 21 | 82 | 32 | 24 | 3671270 | 356390 | " | Gibson | Jefferson | 383 | 123 | 38 |
| 7 | 33 | 05 | 16 | 82 | 37 | 41 | 3662020 | 348080 | " | Downs | " | 278 | 60 | 25 |
| 8 | 33 | 13 | 53 | 82 | 34 | 06 | 3677810 | 353820 | " | " | Glascock | 402 | 33 | 27 |
| 9 | 33 | 13 | 22 | 82 | 35 | 25 | 3676900 | 351760 | " | Gibson | " | 396 | 50 | 16 |
| 10 | 33 | 15 | 40 | 82 | 27 | 08 | 3681000 | 364730 | " | Bowdens Pond | Jefferson | 461 | 141 | 25 |
| 11 | 33 | 22 | 48 | 82 | 26 | 07 | 3694110 | 366490 | " | Dearing | McDuffie | 472 | 28 | 19 |
| 12 | 33 | 22 | 00 | 82 | 29 | 06 | 3692710 | 361810 | " | Bowdens Pond | " | 442 | 7 | 17 |
| 13 | 33 | 10 | 43 | 82 | 32 | 49 | 3672120 | 355770 | " | Gibson | Jefferson | 443 | 160 | 28 |
| 14 | 33 | 13 | 17 | 82 | 30 | 46 | 3676630 | 359040 | " | " | " | 472 | 163 | 32 |
| 15 | 33 | 10 | 59 | 82 | 37 | 02 | 3672530 | 349220 | " | " | Glascock | 297 | 3 | 8 |
| 16 | 33 | 15 | 13 | 82 | 30 | 34 | 3680210 | 359390 | " | Bastonville | " | 440 | 106 | 34 |
| 17 | 33 | 08 | 48 | 82 | 37 | 53 | 3668490 | 347820 | " | Mitchell | " | 437 | 123 | 40 |
| 18 | 33 | 21 | 01 | 82 | 29 | 56 | 3690940 | 360510 | " | Bowdens Pond | McDuffie | 473 | 7 | 10 |
| 19 | 33 | 22 | 13 | 82 | 24 | 03 | 3693000 | 369680 | " | " | " | 490 | 69 | 25 |
| 20 | 33 | 21 | 37 | 82 | 29 | 53 | 3692080 | 360640 | " | " | " | 481 | 49 | 19 |
| 21 | 33 | 20 | 17 | 82 | 24 | 06 | 3689450 | 369560 | " | " | " | 389 | 2 | 14 |
| 22 | 33 | 16 | 17 | 82 | 31 | 19 | 3682230 | 358240 | " | Bastonville | Glascock | 442 | 71 | 16 |
| 23 | 33 | 11 | 24 | 82 | 30 | 38 | 3673170 | 359210 | " | Gibson | Jefferson | 384 | 121 | 10 |
| 24 | 33 | 16 | 45 | 82 | 31 | 01 | 3683080 | 358740 | " | Bastonville | Glascock | 486 | 115 | 20 |
| 25 | 33 | 10 | 55 | 82 | 37 | 44 | 3672440 | 348150 | " | Mitchell | " | 415 | 82 | 29 |
| 26 | 33 | 10 | 29 | 82 | 35 | 04 | 3671590 | 352270 | " | Gibson | " | 334 | 38 | 40 |
| 27 | 33 | 14 | 47 | 82 | 32 | 22 | 3679460 | 356590 | " | " | " | 399 | 38 | 16 |
| 28 | 33 | 13 | 41 | 82 | 31 | 25 | 3677400 | 358040 | " | " | " | 409 | 100 | 21 |
| 29 | 33 | 09 | 06 | 82 | 36 | 55 | 3669080 | 349350 | " | " | " | 451 | 132 | 36 |
| 30 | 33 | 18 | 43 | 82 | 25 | 12 | 3686590 | 367830 | " | Bowdens Pond | Warren | 382 | 54 | 42 |
| 31 | 33 | 21 | 20 | 82 | 29 | 51 | 3691520 | 360670 | " | " | McDuffie | 471 | 31 | 15 |
| 32 | 33 | 20 | 34 | 82 | 22 | 11 | 3689920 | 372540 | " | Avondale | " | 469 | 70 | 25 |

## LOCATION OF SAMPLES

IN FEET

| Sample # | N Latitude o | ' | " | W Longitude o | ' | " | Northing | Easting | 1/250,000 Quadrangle | 1/24,000 Quadrangle | County | Surface Elevation | Overburden Thickness | Ore Thickness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 33 | 17 | 44 | 82 | 25 | 33 | 3684780 | 367260 | Athens | Bowdens Pond | Warren | 450 | 90 | 22 |
| 34 | 33 | 17 | 25 | 82 | 24 | 13 | 3684140 | 369300 | " | " | Jefferson | 416 | 63 | 28 |
| 35 | 33 | 18 | 24 | 82 | 30 | 11 | 3686100 | 360070 | " | Bastonville | Warren | 532 | 112 | 18 |
| 36 | 33 | 20 | 21 | 82 | 23 | 40 | 3689570 | 370270 | " | Bowdens Pond | McDuffie | 407 | 36 | 10 |
| 37 | 33 | 20 | 33 | 82 | 23 | 53 | 3689930 | 369910 | " | " | " | 439 | 44 | 30 |
| 38 | 33 | 19 | 25 | 82 | 26 | 27 | 3687920 | 365920 | " | " | Warren | 439 | 41 | 21 |
| 39 | 33 | 09 | 37 | 82 | 41 | 35 | 3670120 | 342100 | " | Mitchell | Glascock | 370 | 36 | 18 |
| 40 | 33 | 10 | 11 | 82 | 40 | 55 | 3671170 | 343160 | " | " | " | 403 | 96 | 20 |
| 41 | 33 | 14 | 48 | 82 | 31 | 40 | 3679500 | 357670 | " | Gibson | " | 434 | 139 | 20 |
| 42 | 33 | 06 | 30 | 82 | 34 | 51 | 3664230 | 352500 | " | Grange | Jefferson | 327 | 41 | 31 |
| 43 | 33 | 17 | 59 | 82 | 29 | 08 | 3685340 | 361680 | " | Bowdens Pond | Warren | 534 | 126 | 40 |
| 44 | 33 | 11 | 35 | 82 | 38 | 38 | 3673680 | 346780 | " | Mitchell | Glascock | 450 | 110 | 27 |
| 45 | 33 | 05 | 29 | 82 | 37 | 47 | 3662410 | 347920 | " | Downs | " | 284 | 46 | 32 |
| 46 | 33 | 22 | 24 | 82 | 26 | 21 | 3694020 | 366120 | " | Bowdens Pond | McDuffie | 421 | 17 | 19 |
| 47 | 33 | 10 | 23 | 82 | 35 | 44 | 3671430 | 351220 | " | Gibson | Glascock | 278 | 1 | 22 |
| 48 | 33 | 07 | 47 | 82 | 34 | 18 | 3666580 | 353390 | " | " | Jefferson | 416 | 151 | 44 |
| 49 | 33 | 20 | 42 | 82 | 23 | 07 | 3690190 | 371110 | " | Bowdens Mill | McDuffie | 514 | 54 | 40 |
| 50 | 33 | 20 | 41 | 82 | 22 | 52 | 3690170 | 371480 | " | " | Glascock | 490 | 52 | 39 |
| 51 | 33 | 15 | 18 | 82 | 31 | 13 | 3680400 | 358390 | " | Bastonville | " | 479 | 128 | 20 |
| 52 | 33 | 17 | 00 | 82 | 26 | 06 | 3683444 | 366390 | " | Bowdens Mill | Warren | 384 | 30 | 38 |
| 53 | 33 | 09 | 37 | 82 | 33 | 09 | 3669930 | 355230 | " | Gibson | Jefferson | 324 | 108 | 28 |
| 54 | 33 | 08 | 30 | 82 | 33 | 24 | 3667890 | 354800 | " | " | " | 405 | 147 | 33 |
| 55 | 33 | 15 | 30 | 82 | 32 | 51 | 3680820 | 355850 | " | Bastonville | Glascock | 367 | 18 | 5 |
| 56 | 33 | 15 | 41 | 82 | 29 | 29 | 3681050 | 361090 | " | Bowdens Pond | " | 492 | 136 | 36 |
| 57 | 33 | 23 | 54 | 82 | 24 | 42 | 3695240 | 368390 | " | Dearing | McDuffie | 464 | 35 | 5 |
| 58 | 33 | 21 | 48 | 82 | 24 | 38 | 3692260 | 368800 | " | Bowdens Pond | " | 407 | 12 | 19 |
| 59 | 33 | 13 | 13 | 82 | 31 | 35 | 3676570 | 357780 | " | Wrens | Glascock | 452 | 144 | 23 |
| 60 | 33 | 11 | 42 | 82 | 34 | 18 | 3673830 | 353490 | " | Gibson | " | 335 | 31 | 27 |
| 61 | 33 | 13 | 05 | 82 | 37 | 23 | 3676430 | 348720 | " | " | " | 330 | 5 | 23 |
| 62 | 33 | 11 | 54 | 82 | 33 | 33 | 3674190 | 354050 | " | " | " | 357 | 65 | 38 |
| 63 | 33 | 23 | 47 | 82 | 24 | 43 | 3695960 | 368680 | " | Dearing | McDuffie | 485 | 16 | 20 |
| 64 | 33 | 15 | 20 | 82 | 29 | 55 | 3680430 | 360400 | " | Bowdens Pond | Glascock | 508 | 111 | 34 |
| 65 | 33 | 12 | 25 | 82 | 33 | 18 | 3675110 | 354900 | " | Gibson | " | 360 | 58 | 35 |

## LOCATION OF SAMPLES

IN FEET

| Sample # | Latitude | | | Longitude | | | Northing | Easting | 1/250,000 Quadrangle | 1/24,000 Quadrangle | County | Surface Elevation | Overburden Thickness | Ore Thickness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | o | ' | " | o | ' | " | | | | | | | | |
| 66 | 33 | 14 | 20 | 82 | 31 | 31 | 3678620 | 357900 | Athens | Gibson | Glascock | 475 | 148 | 20 |
| 67 | 33 | 10 | 24 | 82 | 40 | 09 | 3671880 | 344370 | " | Mitchell | " | 415 | 63 | 24 |
| 68 | 33 | 06 | 13 | 82 | 34 | 46 | 3663690 | 352630 | " | Grange | Jefferson | 360 | 91 | 28 |
| 69 | 33 | 05 | 51 | 82 | 36 | 07 | 3663050 | 350490 | " | " | " | 442 | 207 | 33 |
| 70 | 33 | 08 | 19 | 82 | 39 | 21 | 3667700 | 345540 | " | Mitchell | Glascock | 419 | 100 | 36 |
| 71 | 33 | 08 | 26 | 82 | 38 | 33 | 3667880 | 346780 | " | " | " | 415 | 113 | 37 |
| 72 | 33 | 08 | 38 | 82 | 39 | 58 | 3668310 | 344590 | " | " | " | 366 | 61 | 34 |
| 73 | 33 | 08 | 39 | 82 | 38 | 44 | 3668280 | 346530 | " | " | " | 440 | 105 | 29 |
| 74 | 33 | 14 | 57 | 82 | 33 | 07 | 3679800 | 355430 | " | Gibson | " | 391 | 52 | 13 |
| 75 | 33 | 09 | 08 | 82 | 36 | 04 | 3669100 | 350660 | " | " | " | 401 | 94 | 20 |
| 76 | 33 | 10 | 56 | 82 | 39 | 19 | 3672510 | 345680 | " | Mitchell | " | 416 | 14 | 32 |
| 77 | 33 | 21 | 01 | 82 | 25 | 54 | 3690850 | 366790 | " | Bowdens Pond | McDuffie | 469 | 63 | 22 |
| 78 | 33 | 18 | 58 | 82 | 26 | 04 | 3687080 | 366480 | " | " | Warren | 435 | 30 | 25 |
| 79 | 33 | 19 | 18 | 82 | 27 | 01 | 3687710 | 365040 | " | " | " | 490 | 70 | 30 |
| 80 | 32 | 51 | 23 | 83 | 11 | 01 | 3637300 | 295670 | Macon | Irwinton | Wilkinson | 300 | 28 | 20 |
| 81 | 32 | 47 | 40 | 83 | 17 | 00 | 3630600 | 286120 | " | Massey Hill | " | 300 | 13 | 25 |
| 82 | 32 | 48 | 20 | 83 | 12 | 15 | 3631700 | 293600 | " | Irwinton | " | - | - | 15 |
| 83 | 32 | 51 | 05 | 83 | 24 | 10 | 3637200 | 275250 | " | Dry Branch | Twiggs | 470 | 34 | 25 |
| 84 | 32 | 49 | 30 | 83 | 24 | 40 | 3634250 | 274350 | " | " | " | 420 | 18 | 25 |
| 85 | 32 | 48 | 25 | 83 | 23 | 20 | 3632250 | 276300 | " | " | " | 350 | 19 | 25 |
| 86 | 32 | 47 | 00 | 83 | 23 | 15 | 3629600 | 276450 | " | " | " | 340 | 33 | 25 |
| 87 | 32 | 51 | 10 | 83 | 20 | 15 | 3637200 | 281270 | " | Massey Hill | Wilkinson | 406 | 30 | 25 |
| 88 | 32 | 44 | 30 | 83 | 17 | 05 | 3624700 | 285950 | " | Jeffersonville | " | 360 | 46 | 30 |
| 89 | 33 | 00 | 30 | 83 | 02 | 35 | 3653900 | 309150 | Athens | Friendship | Washington | 360 | 40 | 20 |
| 90* | 32 | 50 | 20 | 83 | 02 | 20 | 3635050 | 309150 | Macon | Toomsboro | Wilkinson | 275/285 | 35 | 35 |
| 91 | 32 | 52 | 55 | 83 | 09 | 30 | 3638230 | 298020 | " | Napier Pond | " | 280 | 15 | 25 |
| 92 | 32 | 54 | 40 | 83 | 06 | 15 | 3643200 | 303150 | " | Gumm Pond | " | 330 | 60 | 35 |
| 93 | 32 | 54 | 10 | 83 | 06 | 00 | 3642250 | 303650 | " | " | " | - | - | 35 |
| 94 | 32 | 59 | 55 | 83 | 02 | 25 | 3652500 | 309400 | " | " | Washington | 290 | 10 | 25 |
| 95 | 32 | 54 | 20 | 83 | 13 | 15 | 3642800 | 292300 | " | Napier Pond | Wilkinson | - | - | 35 |
| 96 | 32 | 53 | 55 | 83 | 12 | 15 | 3642050 | 293800 | " | " | " | 430 | 100 | 35 |

* 2 samples

## LOCATION OF SAMPLES

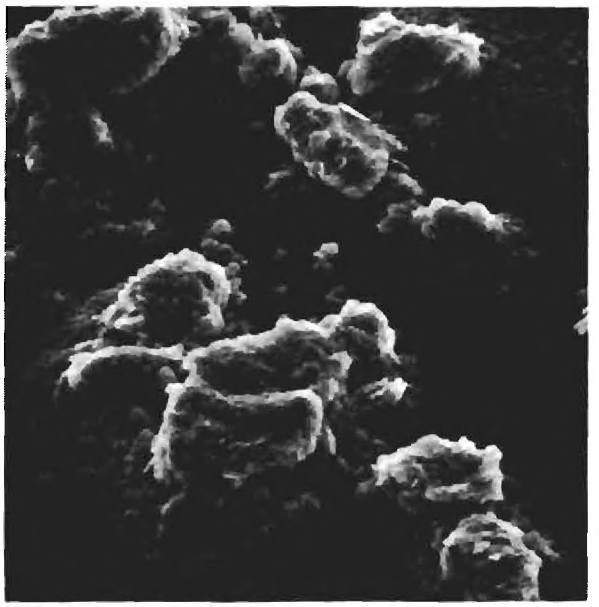
IN FEET

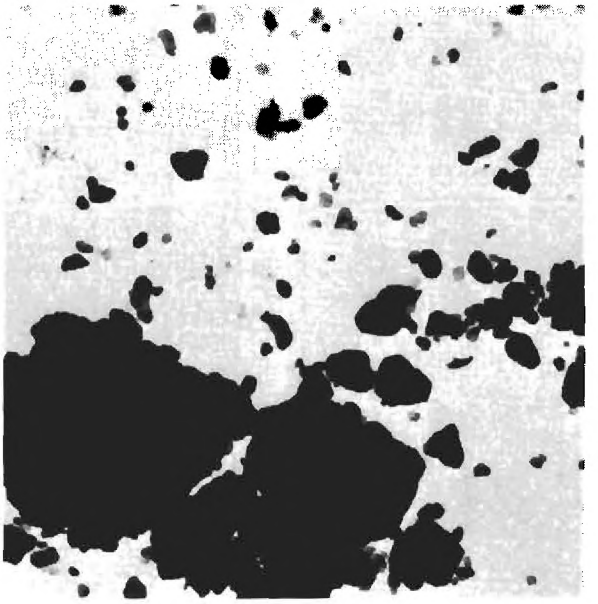
| Sample # | Latitude o | ' | " | Longitude o | ' | " | Northing | Easting | 1/250,000 Quadrangle | 1/24,000 Quadrangle | County | Surface Elevation | Overburden Thickness | Ore Thickness |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 97 | 33 | 02 | 55 | 83 | 04 | 10 | 3658350 | 306800 | Athens | Friendship | Baldwin | 430 | 82 | 25 |
| 98 | 32 | 44 | 45 | 83 | 28 | 45 | 3625650 | 267750 | Macon | Marion | Twiggs | 440 | 95 | 40 |
| 99 | 32 | 45 | 05 | 83 | 28 | 10 | 3626300 | 268600 | " | Dry Branch | " | 470 | 135 | 25 |
| 100 | 32 | 41 | 30 | 83 | 28 | 40 | 3619650 | 267650 | " | Marion | " | 400 | 140 | 40 |
| 101 | 32 | 42 | 20 | 83 | 31 | 00 | 3621250 | 264050 | " | Warner Robbins | " | 435 | 38 | 30 |
| 102* | 32 | 52 | 25 | 83 | 01 | 00 | 3648450 | 311100 | " | Toomsboro | Washington | 365 | 45/80 | 15/40 |
| 103 | 32 | 47 | 32 | 83 | 19 | 27 | 3630450 | 282350 | " | Massey Hill | Wilkinson | 365 | 30 | 25 |
| 104 | 32 | 48 | 32 | 83 | 02 | 58 | 3631820 | 307780 | " | Toomsboro | " | 260 | 20 | - |
| 105 | 32 | 51 | 50 | 82 | 57 | 25 | 3637700 | 316900 | " | Oconee | Washington | 265 | 45 | - |
| 106 | 32 | 42 | 35 | 83 | 16 | 30 | 3621150 | 286800 | " | Jeffersonville | Wilkinson | 365 | 50 | 30 |
| 107 | 33 | 01 | 50 | 82 | 59 | 20 | 3656300 | 314150 | Athens | Deepstep | Washington | 285 | 10 | - |
| 108 | 32 | 53 | 30 | 82 | 59 | 00 | 3640850 | 314400 | Macon | Tabernacle | " | 265 | 15 | - |
| 109 | 32 | 56 | 10 | 83 | 01 | 50 | 3645800 | 310150 | " | Gumm Pond | " | 300 | 20 | - |
| 110 | 32 | 58 | 10 | 83 | 01 | 00 | 3649550 | 311500 | " | " | " | 320 | 30 | - |
| 111 * | 32 | 57 | 10 | 82 | 59 | 55 | 3647600 | 313200 | " | Tabernacle | " | 300 | 18/55 | 9/11 |
| 112 * | 32 | 57 | 50 | 82 | 58 | 55 | 3648850 | 314750 | " | " | " | 350 | 20/54 | 4/10 |
| 113 | 32 | 58 | 20 | 82 | 58 | 55 | 3649700 | 314750 | " | " | " | 285 | 60 | 11 |
| 114 | 33 | 00 | 40 | 82 | 56 | 05 | 3653950 | 319250 | Athens | Deepstep | " | 255 | 20 | 7 |
| 115 | 33 | 03 | 25 | 82 | 38 | 25 | 3658550 | 346850 | " | Downs | " | 380 | 182 | 34 |
| 116 | 32 | 16 | 25 | 84 | 11 | 50 | 3578900 | 764000 | Phoenix City | Ideal South | Macon | 400 | 29 | 20 |
| 117 | 32 | 51 | 17 | 83 | 07 | 15 | 3637000 | 301540 | Macon | Toomsboro | Wilkinson | 277 | 14 | 46 |
| 118 | 32 | 50 | 33 | 83 | 05 | 28 | 3635570 | 304290 | " | " | " | 298 | 16 | 60 |
| 119 | 32 | 47 | 50 | 83 | 04 | 00 | 3630500 | 306480 | " | " | " | 266 | 43 | 109 |
| 120 | 32 | 52 | 40 | 83 | 08 | 20 | 3639550 | 299870 | " | Napier Pond | " | 315 | 3 | 40 |

* 2 samples

# Appendix 2

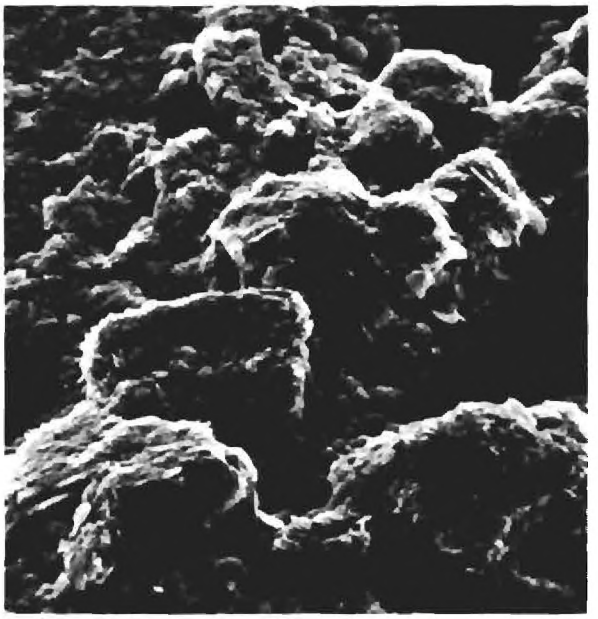
## Transmission and Scanning Electromicroscope Photographs, Spatial Data, and Chemical Analysis of Each Individual Core Sample, by Sample (Core) Number

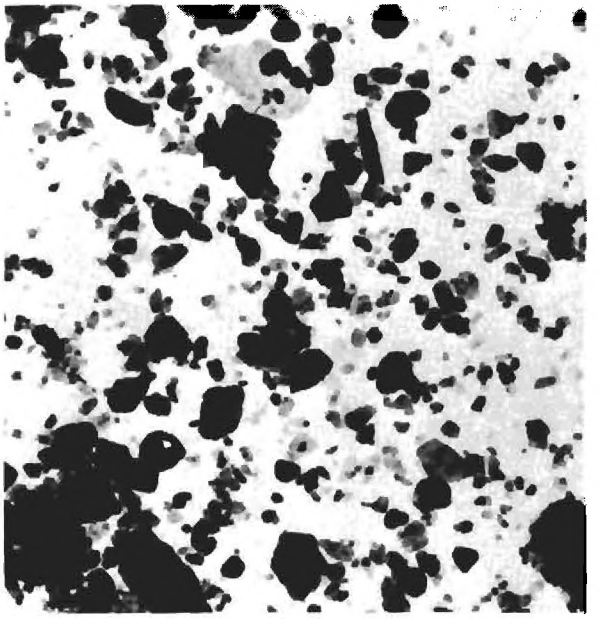




SEM 2000X TEM 8300X

SAMPLE 00001



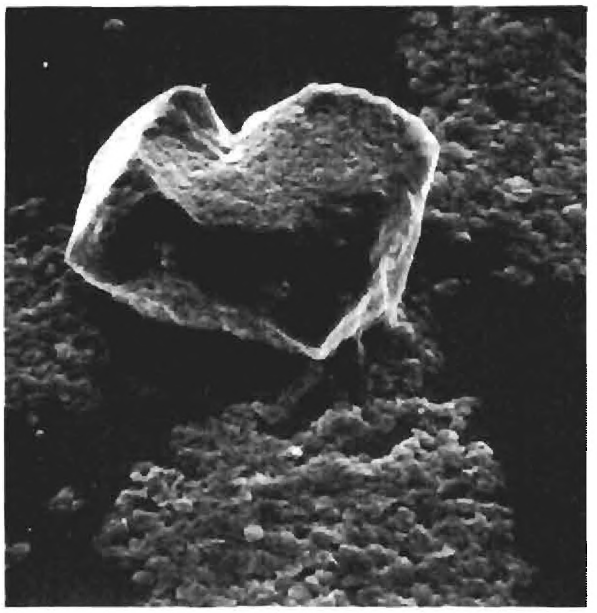


SEM 2000X TEM 8300X

SAMPLE 00002

| SAMPLE 1 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 05" | $K_2O$ | 0.35 | % |
| Longitude: | 82° 27' 23" | CaO | 0.03 | |
| Northing: | 3679920 | MgO | 0.90 | |
| Easting: | 364220 | $Al_2O_3$ | 34.58 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.35 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.20 | |
| County: | Jefferson | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 492' | $Fe_2O_3$ | 1.20 | |
| Overburden Thickness: | 170' | $P_2O_5$ | 0.000458 | |
| Ore Thickness: | 20' | F | 0.0137 | |

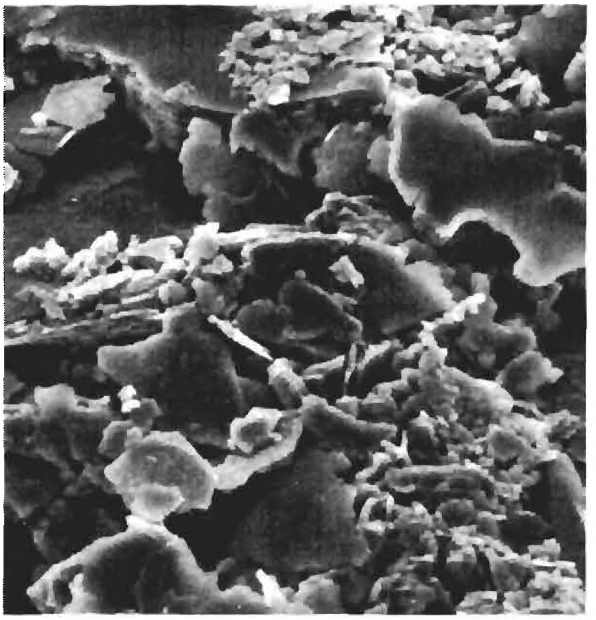
| SAMPLE 2 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 25" | $K_2O$ | 0.37 | % |
| Longitude: | 82" 26' 01" | CaO | 0.06 | |
| Northing: | 3691560 | MgO | 0.65 | |
| Easting: | 366620 | $Al_2O_3$ | 36.03 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.41 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.18 | |
| County: | McDuffie | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 451' | $Fe_2O_3$ | 1.14 | |
| Overburden Thickness: | 33' | $P_2O_5$ | 0.103111 | |
| Ore Thickness: | 22' | F | 0.0105 | |



SEM 2000X

TEM 8300X

SAMPLE 00003



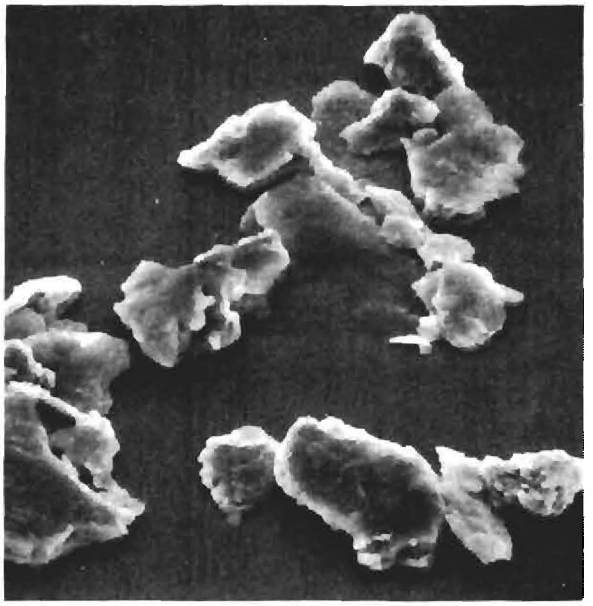
SEM 2000X

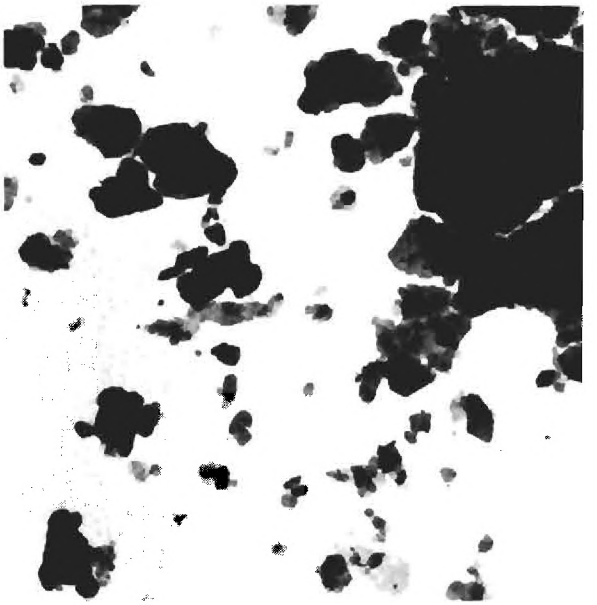
TEM 8300X

SAMPLE 00004

| SAMPLE 3 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 39" | $K_2O$ | 0.41 | % |
| Longitude: | 82° 24' 27" | CaO | 0.10 | |
| Northing: | 3690110 | MgO | 1.23 | |
| Easting: | 369030 | $Al_2O_3$ | 34.96 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.69 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.48 | |
| County: | McDuffie | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 387' | $Fe_2O_3$ | 0.89 | |
| Overburden Thickness: | 12' | $P_2O_5$ | 0.048119 | |
| Ore Thickness: | 11' | F | 0.0084 | |

| SAMPLE 4 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 22' 09" | $K_2O$ | 0.19 | % |
| Longitude: | 82° 23' 20" | CaO | 0.06 | |
| Northing: | 3692840 | MgO | 1.09 | |
| Easting: | 370800 | $Al_2O_3$ | 36.03 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.15 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.17 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 386' | $Fe_2O_3$ | 0.56 | |
| Overburden Thickness: | 5' | $P_2O_5$ | 0.258924 | |
| Ore Thickness: | 10' | F | 0.0061 | |

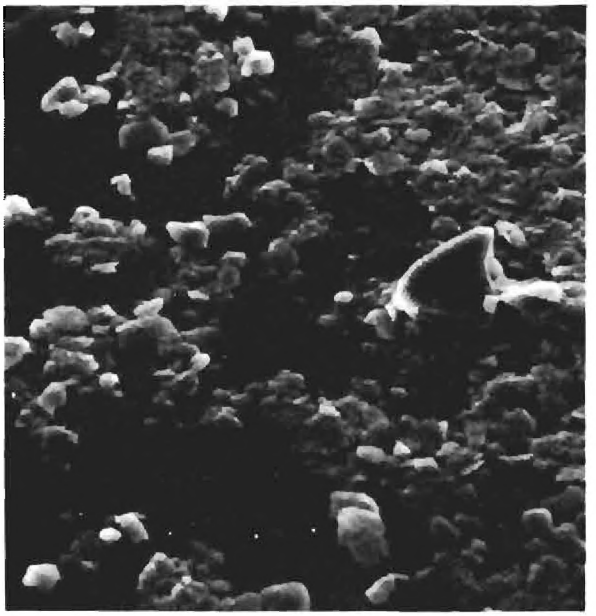




SEM 2000X

TEM 8300X

SAMPLE 00005



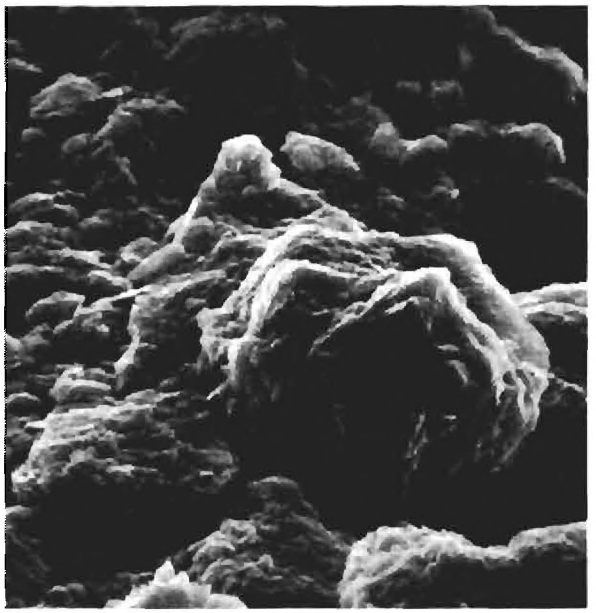
SEM 2000X

TEM 8300X

SAMPLE 00006

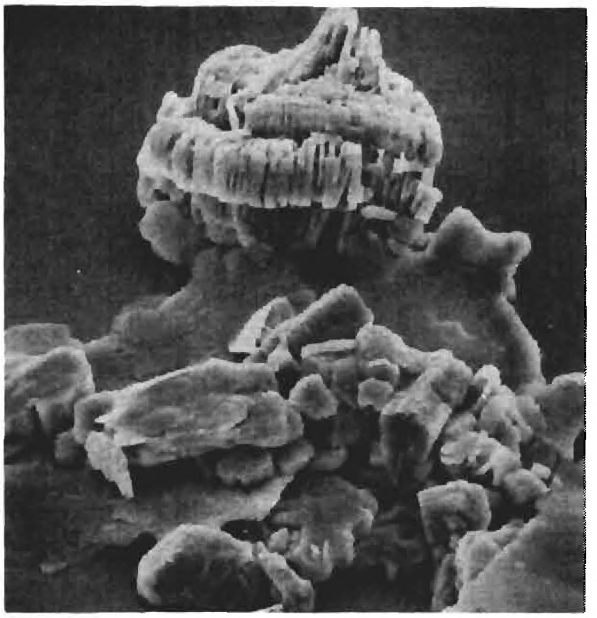
| SAMPLE 5 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 28" | $K_2O$ | 0.20 | % |
| Longitude: | 82° 24' 02" | CaO | 0.14 | |
| Northing: | 3691660 | MgO | 0.76 | |
| Easting: | 369270 | $Al_2O_3$ | 36.41 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.39 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.30 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 428' | $Fe_2O_3$ | 0.79 | |
| Overburden Thickness: | 42' | $P_2O_5$ | 0.057284 | |
| Ore Thickness: | 32' | F | 0.0060 | |

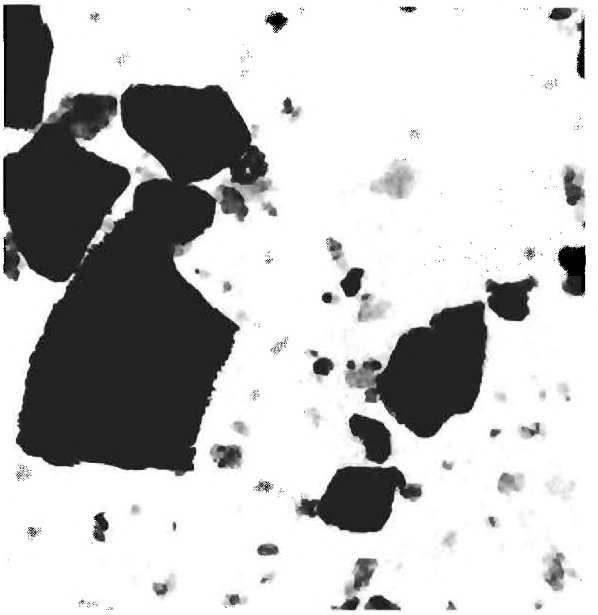
| SAMPLE 6 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 21" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 32' 24" | CaO | 0.07 | |
| Northing: | 3671270 | MgO | 0.15 | |
| Easting: | 356390 | $Al_2O_3$ | 38.43 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 44.99 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.28 | |
| County: | Jefferson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 383' | $Fe_2O_3$ | 0.76 | |
| Overburden Thickness: | 123' | $P_2O_5$ | 0.103111 | |
| Ore Thickness: | 38' | F | 0.0063 | |



SEM 2000X TEM 8300X

SAMPLE 00007



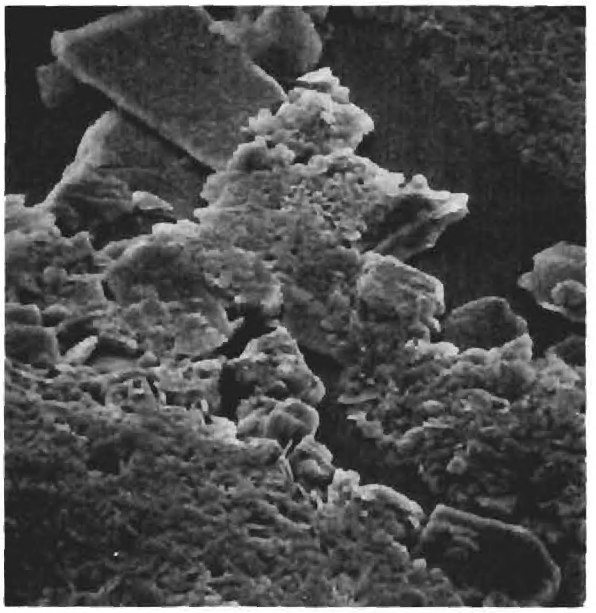


SEM 2000X TEM 8300X

SAMPLE 00008

| SAMPLE 7 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 05' 16" | $K_2O$ | 0.19 | % |
| Longitude: | 82° 37' 41" | CaO | 0.15 | |
| Northing: | 3662020 | MgO | 0.76 | |
| Easting: | 348080 | $Al_2O_3$ | 37.86 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.97 | |
| 1/24,000 Quadrangle: | Downs | $TiO_2$ | 1.07 | |
| County: | Jefferson | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 278' | $Fe_2O_3$ | 1.83 | |
| Overburden Thickness: | 60' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 25' | F | 0.0056 | |

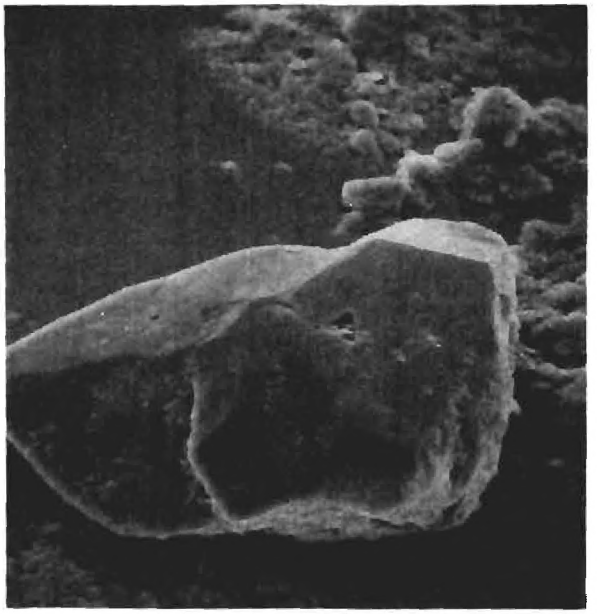
| SAMPLE 8 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 53" | $K_2O$ | 0.16 | % |
| Longitude: | 82° 34' 06" | CaO | 0.06 | |
| Northing: | 3677810 | MgO | 0.18 | |
| Easting: | 353820 | $Al_2O_3$ | 36.39 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.84 | |
| 1/24,000 Quadrangle: | Downs | $TiO_2$ | 0.47 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 402' | $Fe_2O_3$ | 0.81 | |
| Overburden Thickness: | 33' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 27' | F | 0.0049 | |

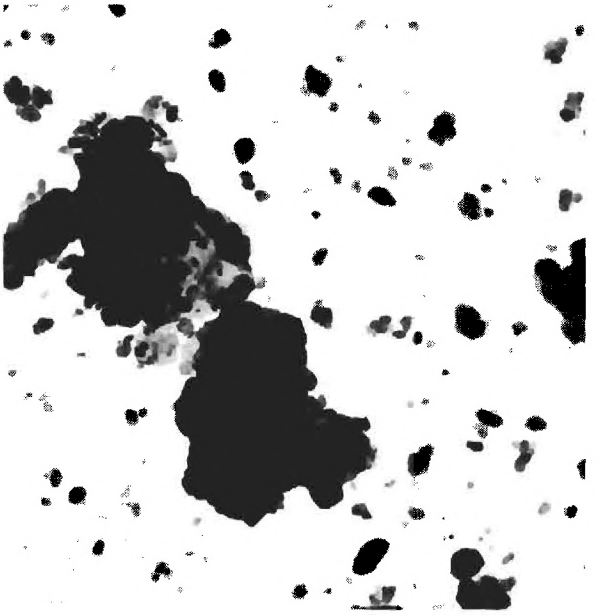


SEM 2000X

TEM 8300X

SAMPLE 00009





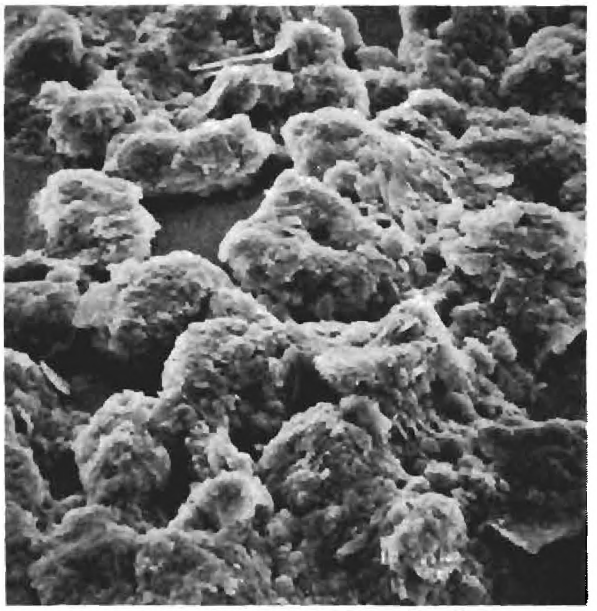
SEM 2000X

TEM 8300X

SAMPLE 00010

| SAMPLE 9 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 22" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 35' 25" | CaO | 0.11 | |
| Northing: | 3676900 | MgO | 0.73 | |
| Easting: | 351760 | $Al_2O_3$ | 38.92 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.59 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.87 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 396' | $Fe_2O_3$ | 0.73 | |
| Overburden Thickness: | 50' | $P_2O_5$ | 0.022914 | |
| Ore Thickness: | 16' | F | 0.0121 | |

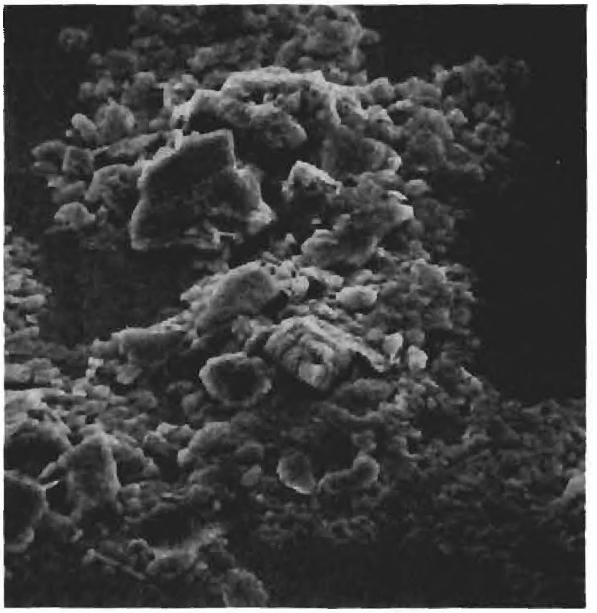
| SAMPLE 10 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 40" | $K_2O$ | 0.10 | % |
| Longitude: | 82° 27' 08" | CaO | 0.28 | |
| Northing: | 3681000 | MgO | 0.63 | |
| Easting: | 364730 | $Al_2O_3$ | 34.48 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 50.79 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.50 | |
| County: | Jefferson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 461' | $Fe_2O_3$ | 0.99 | |
| Overburden Thickness: | 141' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 25' | F | 0.0054 | |



SEM 2000X

TEM 8300X

SAMPLE 00011



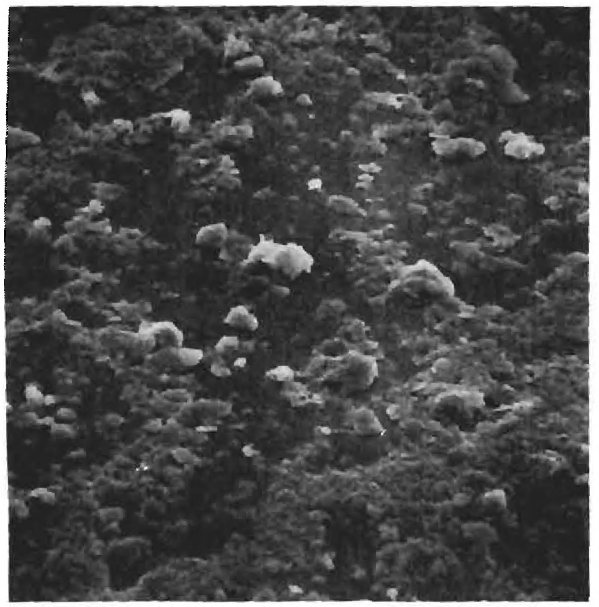
SEM 2000X

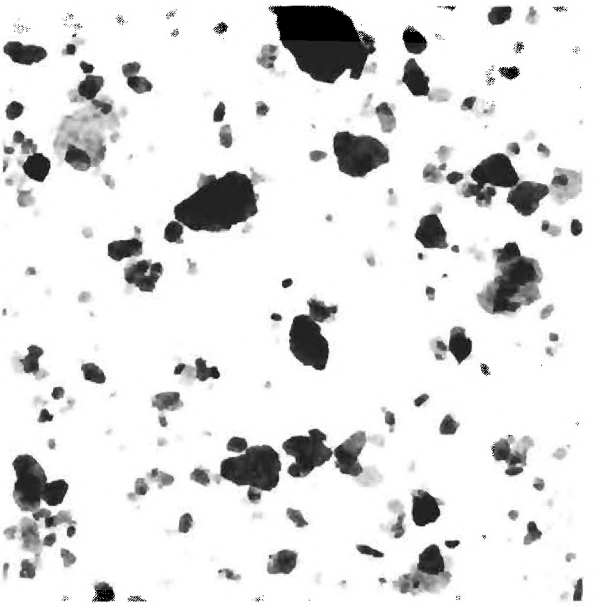
TEM 8300X

SAMPLE 00012

| SAMPLE 11 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 22' 48" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 26' 07" | CaO | 0.20 | |
| Northing: | 3694110 | MgO | 0.28 | |
| Easting: | 366490 | $Al_2O_3$ | 37.68 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.63 | |
| 1/24,000 Quadrangle: | Dearing | $TiO_2$ | 1.02 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 472' | $Fe_2O_3$ | 1.04 | |
| Overburden Thickness: | 28' | $P_2O_5$ | 0.034370 | |
| Ore Thickness: | 19' | F | 0.0018 | |

| SAMPLE 12 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 22' 00" | $K_2O$ | 0.46 | % |
| Longitude: | 82° 29' 06" | CaO | 0.08 | |
| Northing: | 3692710 | MgO | 0.73 | |
| Easting: | 361810 | $Al_2O_3$ | 35.37 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.35 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 2.62 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 442' | $Fe_2O_3$ | 0.67 | |
| Overburden Thickness: | 7' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 17' | F | 0.0026 | |

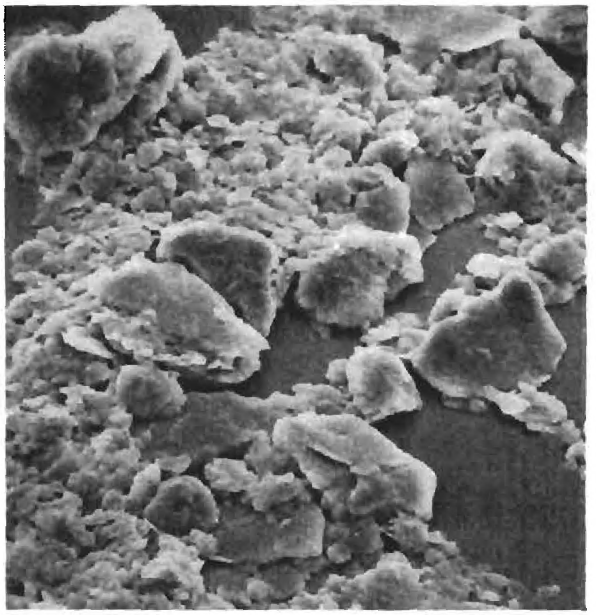




SEM 2000X

TEM 8300X

SAMPLE 00013



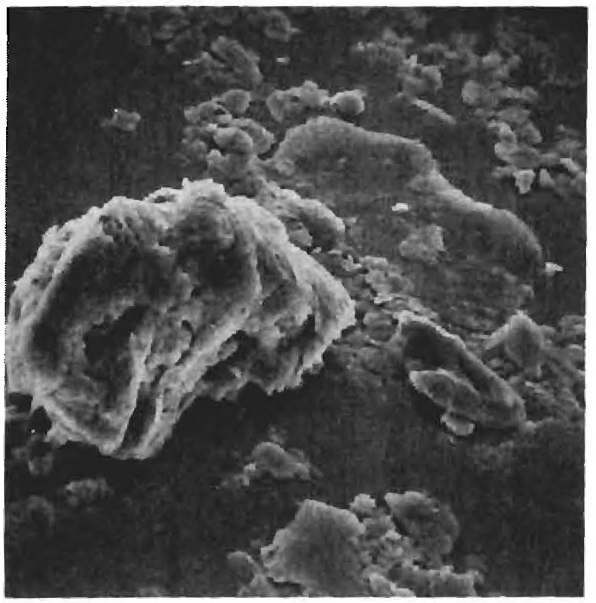
SEM 2000X

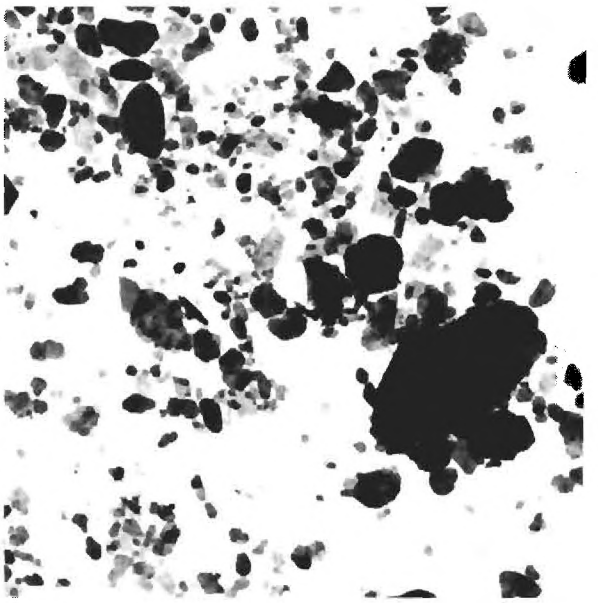
TEM 8300X

SAMPLE 00014

| SAMPLE 13 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 43" | $K_2O$ | 0.17 | % |
| Longitude: | 82° 32' 49" | CaO | 0.21 | |
| Northing: | 3672120 | MgO | 0.53 | |
| Easting: | 355770 | $Al_2O_3$ | 34.99 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.70 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.95 | |
| County: | Jefferson | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 443' | $Fe_2O_3$ | 0.89 | |
| Overburden Thickness: | 160' | $P_2O_5$ | 0.018331 | |
| Ore Thickness: | 28' | F | 0.0075 | |

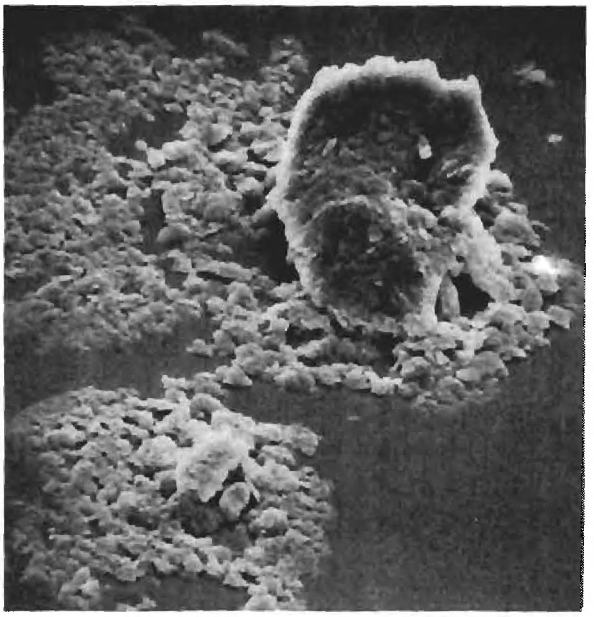
| SAMPLE 14 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 17" | $K_2O$ | 0.23 | % |
| Longitude: | 82° 30' 46" | CaO | 0.17 | |
| Northing: | 3676630 | MgO | 0.99 | |
| Easting: | 359040 | $Al_2O_3$ | 36.64 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 43.81 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 2.97 | |
| County: | Jefferson | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 472' | $Fe_2O_3$ | 0.87 | |
| Overburden Thickness: | 163' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 32' | F | 0.0060 | |





SEM 2000X TEM 8300X

SAMPLE 00015

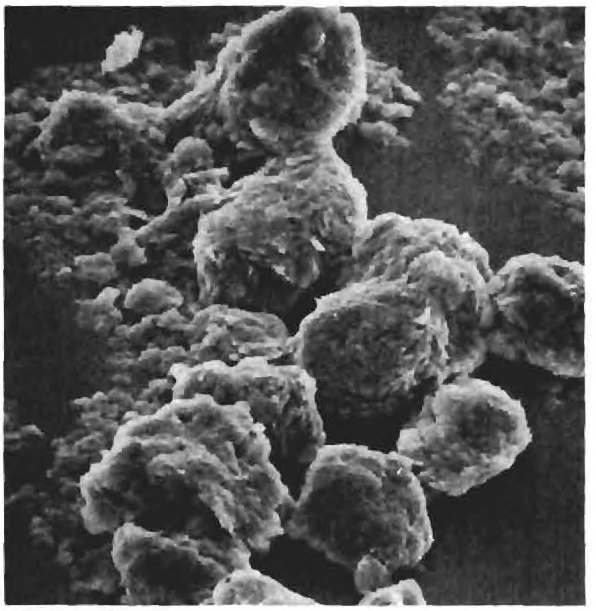


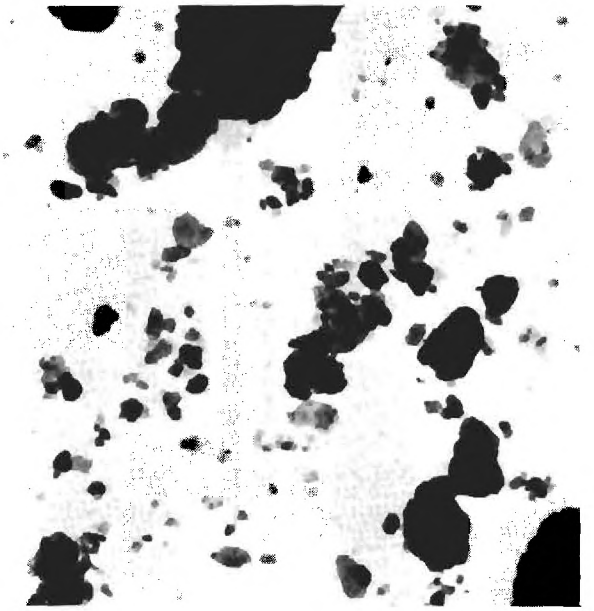
SEM 2000X TEM 8300X

SAMPLE 00016

| SAMPLE 15 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 59" | $K_2O$ | 0.17 | % |
| Longitude: | 82° 37' 02" | CaO | 0.06 | |
| Northing: | 3672530 | MgO | 1.19 | |
| Easting: | 349220 | $Al_2O_3$ | 35.88 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.20 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.85 | |
| County: | Glascock | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 297' | $Fe_2O_3$ | 0.70 | |
| Overburden Thickness: | 3' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 8' | F | 0.0092 | |

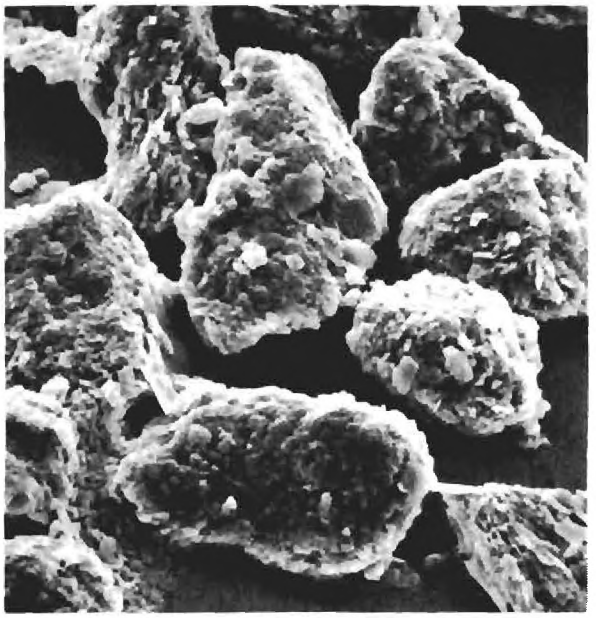
| SAMPLE 16 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 13" | $K_2O$ | 0.39 | % |
| Longitude: | 82° 30' 34" | CaO | 0.50 | |
| Northing: | 3680210 | MgO | 0.43 | |
| Easting: | 359390 | $Al_2O_3$ | 34.96 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.17 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 0.95 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 440' | $Fe_2O_3$ | 1.00 | |
| Overburden Thickness: | 106' | $P_2O_5$ | 0.286420 | |
| Ore Thickness: | 34' | F | 0.0052 | |





SEM 2000X TEM 8300X

SAMPLE 00017

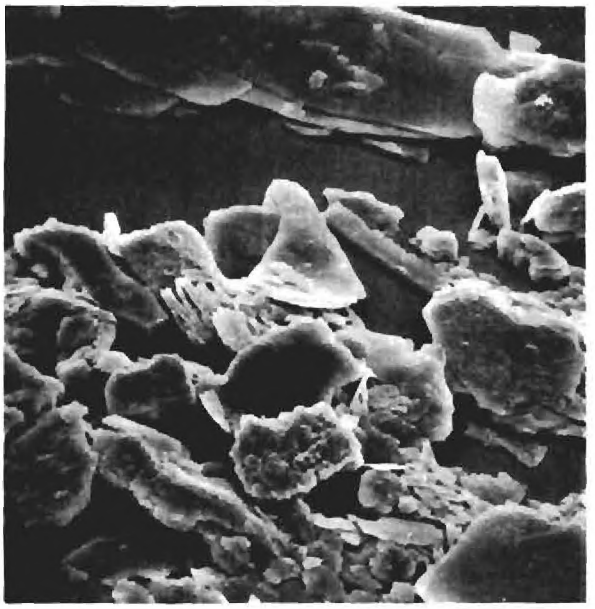


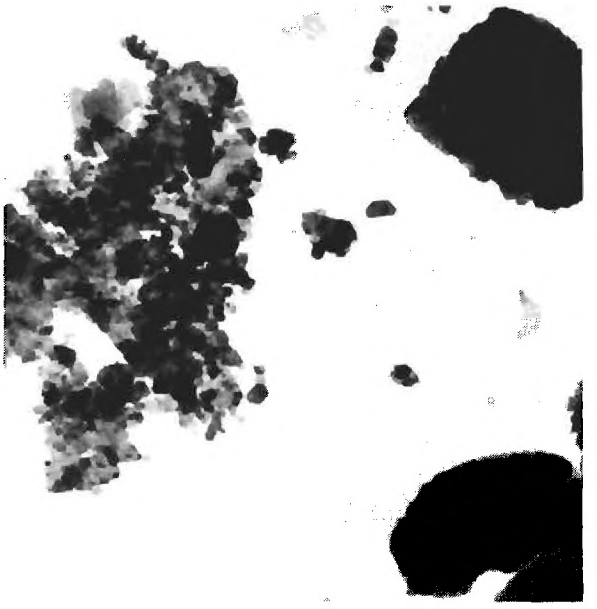
SEM 2000X TEM 8300X

SAMPLE 00018

| SAMPLE 17 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 08' 48" | $K_2O$ | 0.82 | % |
| Longitude: | 82° 37' 53" | CaO | 0.15 | |
| Northing: | 3668490 | MgO | 0.33 | |
| Easting: | 347820 | $Al_2O_3$ | 37.30 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.97 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.48 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 437' | $Fe_2O_3$ | 1.17 | |
| Overburden Thickness: | 123' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 40' | F | 0.0023 | |

| SAMPLE 18 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 01" | $K_2O$ | 0.65 | % |
| Longitude: | 82° 29' 56" | CaO | 0.25 | |
| Northing: | 3690940 | MgO | 0.55 | |
| Easting: | 360510 | $Al_2O_3$ | 36.66 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.63 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.03 | |
| County: | McDuffie | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 473' | $Fe_2O_3$ | 0.90 | |
| Overburden Thickness: | 7' | $P_2O_5$ | 0.018331 | |
| Ore Thickness: | 10' | F | 0.0097 | |

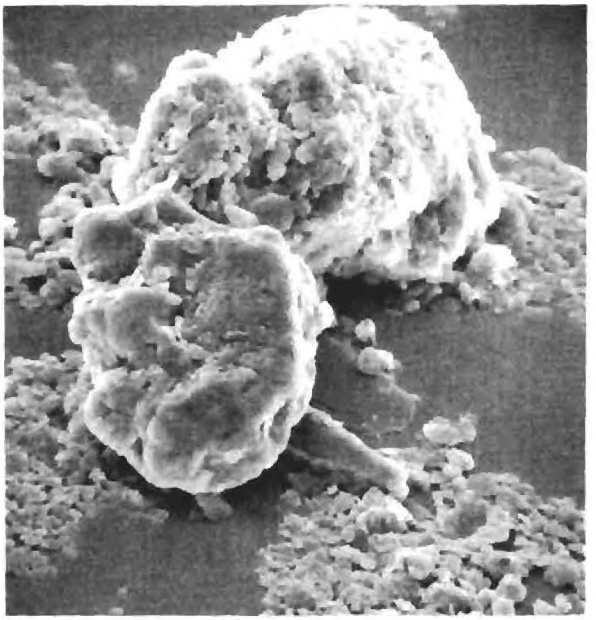


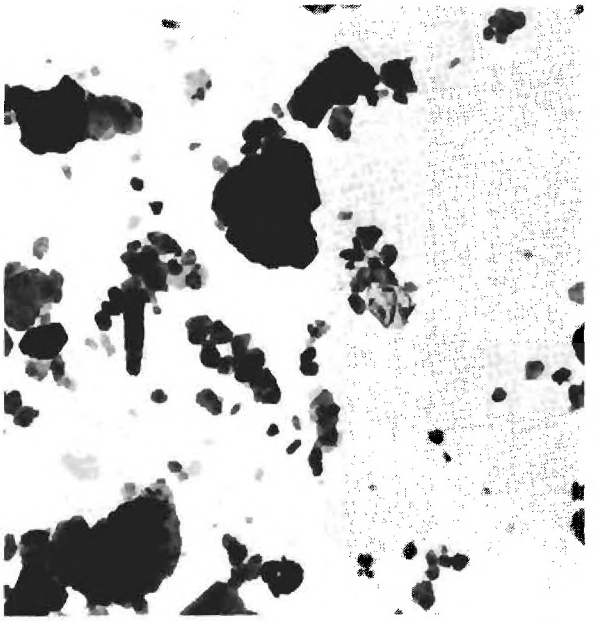


SEM 2000X

TEM 8300X

SAMPLE 00019





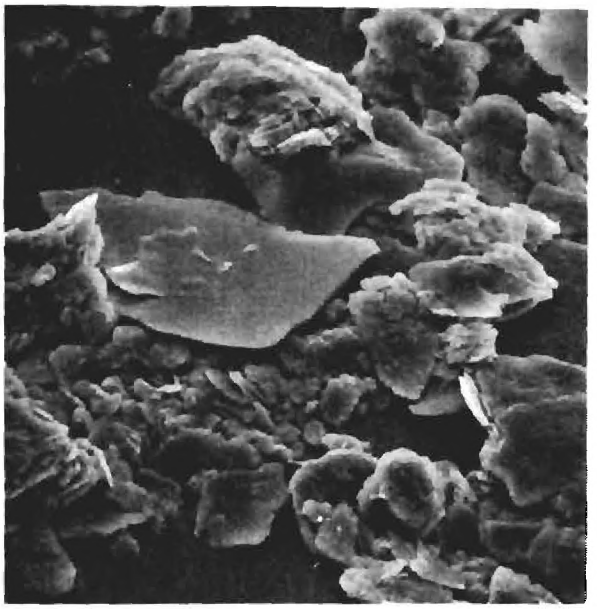
SEM 2000X

TEM 8300X

SAMPLE 00020

| SAMPLE 19 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 22' 13" | $K_2O$ | 0.19 | % |
| Longitude: | 82° 24' 03" | CaO | 0.85 | |
| Northing: | 3693000 | MgO | 0.27 | |
| Easting: | 369680 | $Al_2O_3$ | 35.62 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.64 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.98 | |
| County: | McDuffie | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 490' | $Fe_2O_3$ | 1.24 | |
| Overburden Thickness: | 69' | $P_2O_5$ | 0.011457 | |
| Ore Thickness: | 25' | F | 0.0099 | |

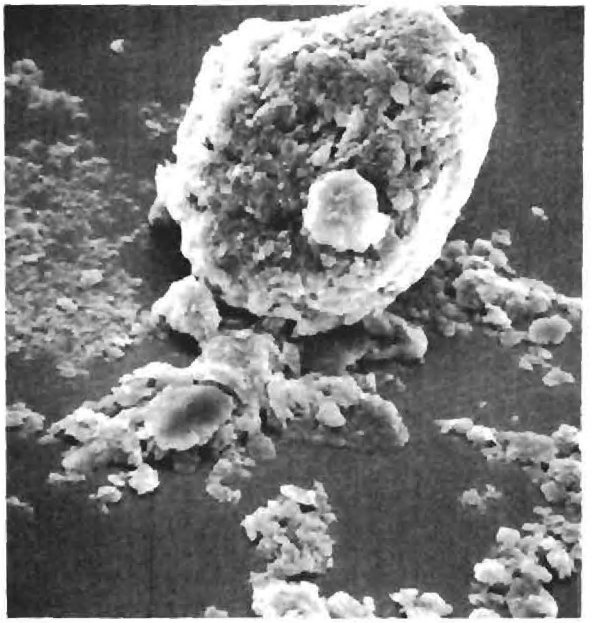
| SAMPLE 20 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 37" | $K_2O$ | 0.12 | % |
| Longitude: | 82° 29' 53" | CaO | 1.02 | |
| Northing: | 3692080 | MgO | 0.80 | |
| Easting: | 360640 | $Al_2O_3$ | 36.90 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.56 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.63 | |
| County: | McDuffie | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 481' | $Fe_2O_3$ | 1.37 | |
| Overburden Thickness: | 49' | $P_2O_5$ | 0.064158 | |
| Ore Thickness: | 19' | F | 0.0085 | |

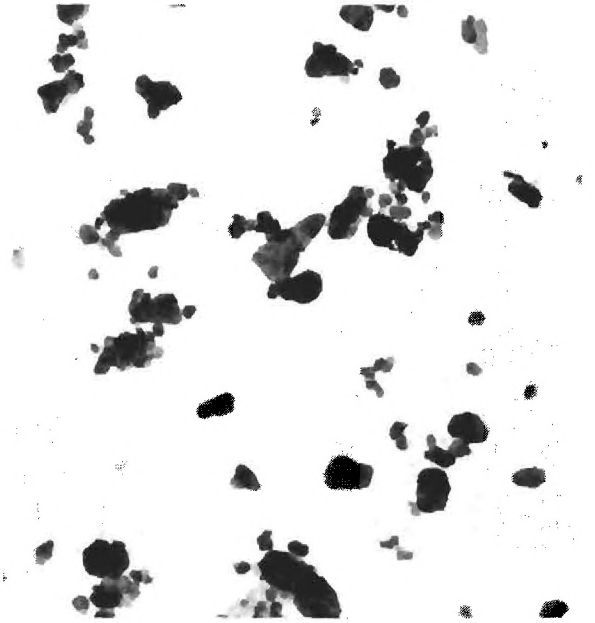


SEM 2000X

TEM 8300X

SAMPLE 00021





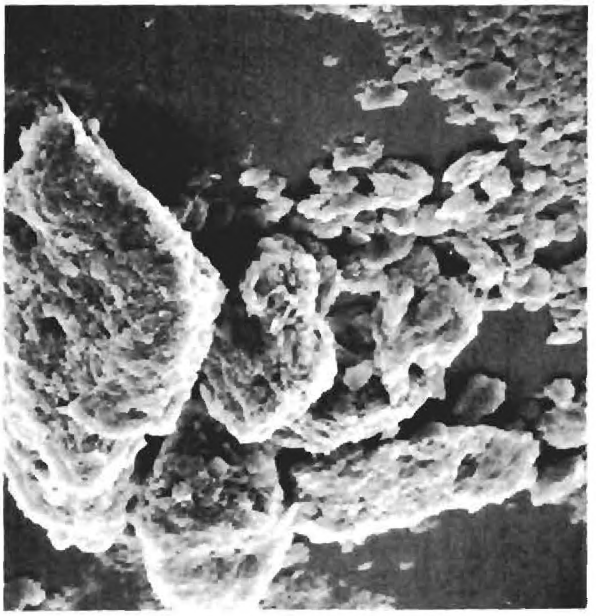
SEM 2000X

TEM 8300X

SAMPLE 00022

| SAMPLE 21 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 17" | $K_2O$ | 0.46 | % |
| Longitude: | 82° 24' 06" | CaO | 0.07 | |
| Northing: | 3689450 | MgO | 0.46 | |
| Easting: | 369560 | $Al_2O_3$ | 33.86 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.15 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.93 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 389' | $Fe_2O_3$ | 1.00 | |
| Overburden Thickness: | 2' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 14' | F | 0.0056 | |

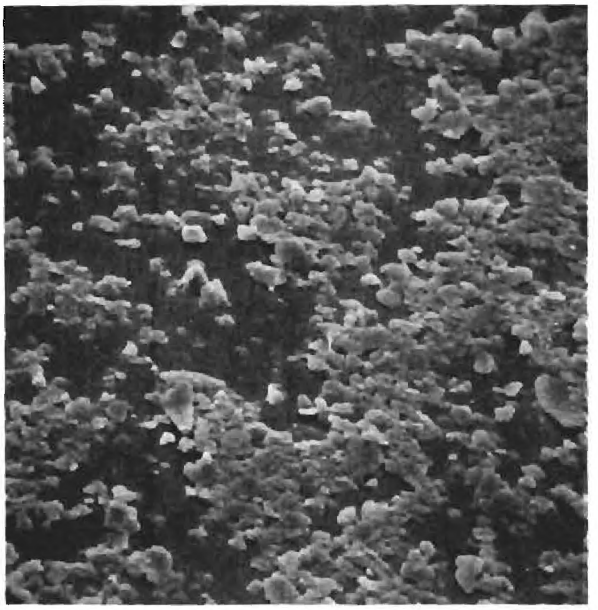
| SAMPLE 22 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 16' 17" | $K_2O$ | 0.18 | % |
| Longitude: | 82° 31' 19" | CaO | 0.14 | |
| Northing: | 3682230 | MgO | 0.73 | |
| Easting: | 358240 | $Al_2O_3$ | 34.96 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.66 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 1.37 | |
| County: | Glascock | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 442' | $Fe_2O_3$ | 0.61 | |
| Overburden Thickness: | 71' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 16' | F | 0.0049 | |

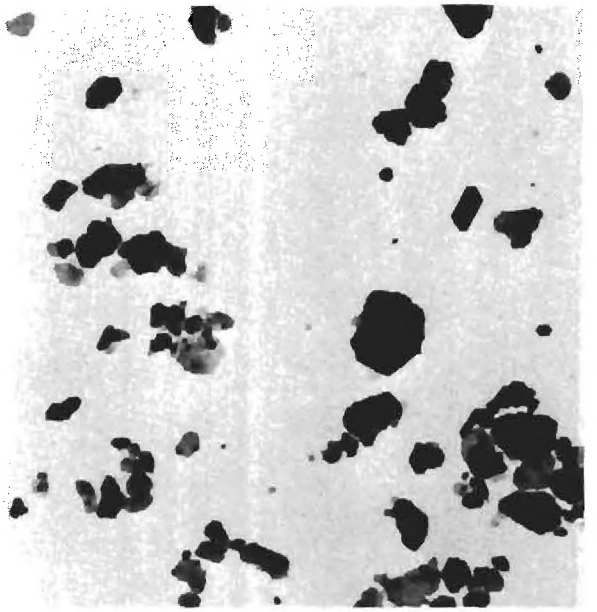


SEM 2000X

TEM 8300X

SAMPLE 00023





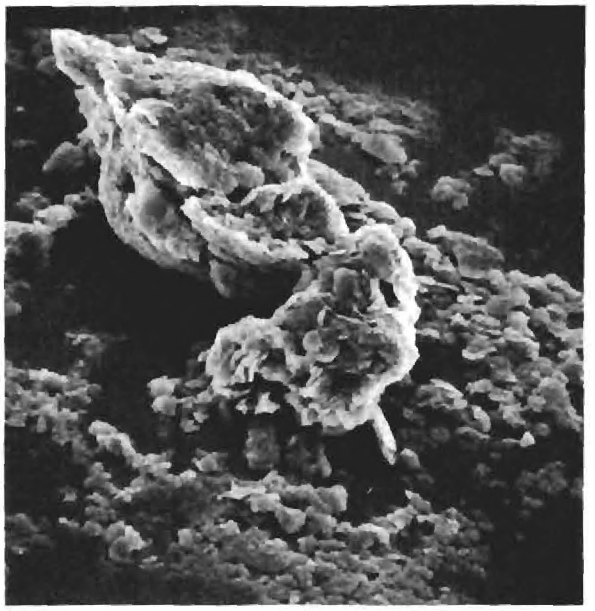
SEM 2000X

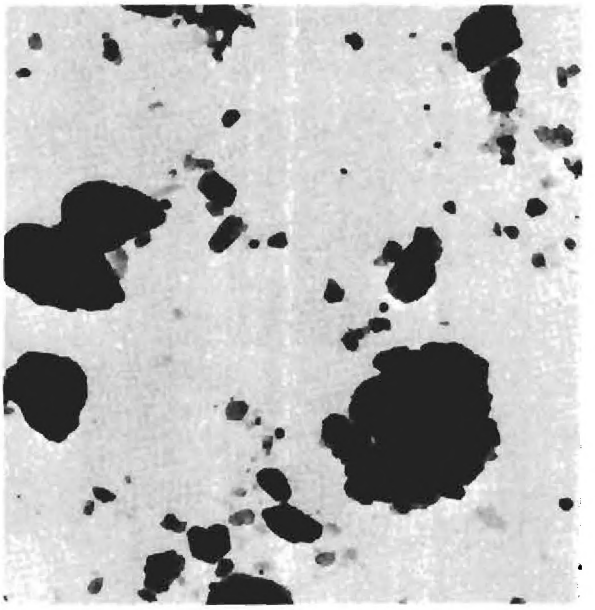
TEM 8300X

SAMPLE 00024

| SAMPLE 23 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 11' 24" | $K_2O$ | 0.18 | % |
| Longitude: | 82° 30' 38" | CaO | 0.01 | |
| Northing: | 3673170 | MgO | 0.63 | |
| Easting: | 359210 | $Al_2O_3$ | 35.22 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.80 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.25 | |
| County: | Jefferson | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 384' | $Fe_2O_3$ | 0.94 | |
| Overburden Thickness: | 121' | $P_2O_5$ | 0.00917 | |
| Ore Thickness: | 10' | F | 0.0065 | |

| SAMPLE 24 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 16' 45" | $K_2O$ | 0.19 | % |
| Longitude: | 82° 31' 01" | CaO | 1.33 | |
| Northing: | 3683080 | MgO | 0.15 | |
| Easting: | 358740 | $Al_2O_3$ | 34.18 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.70 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 2.20 | |
| County: | Glascock | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 486' | $Fe_2O_3$ | 0.56 | |
| Overburden Thickness: | 115' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 20' | F | 0.0065 | |

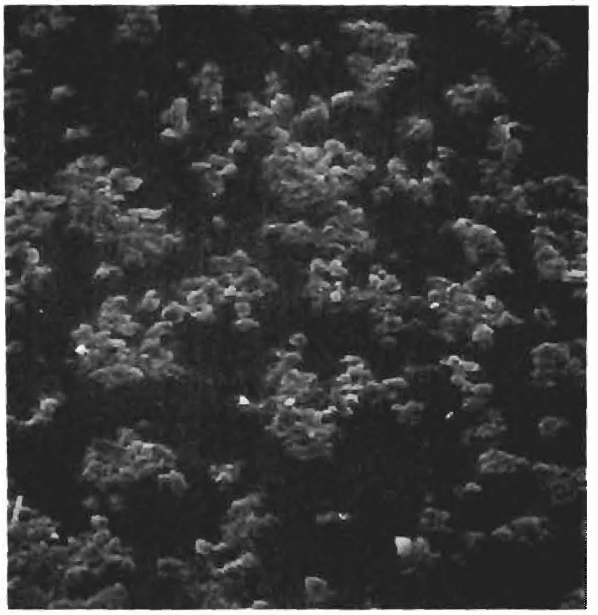


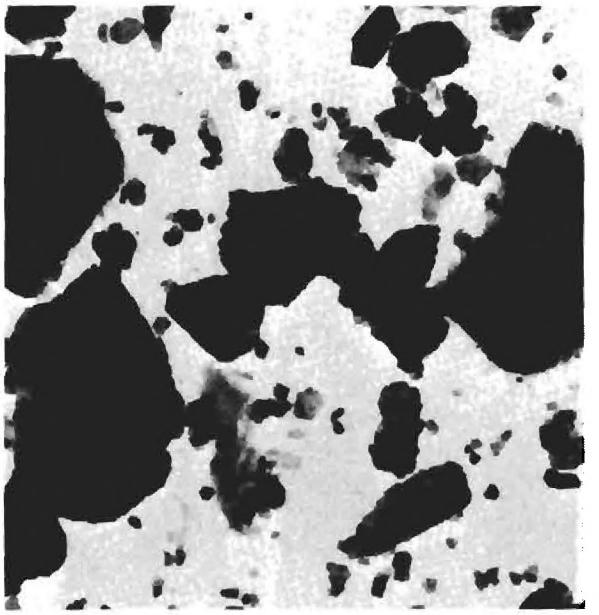


SEM 2000X

TEM 8300X

SAMPLE 00025





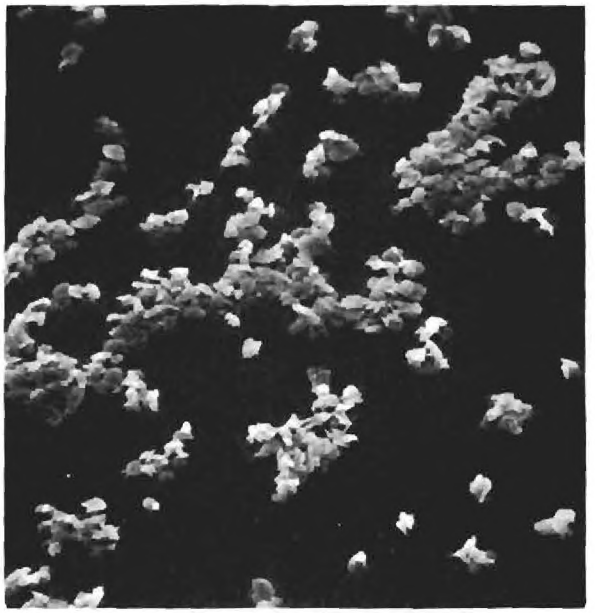
SEM 2000X

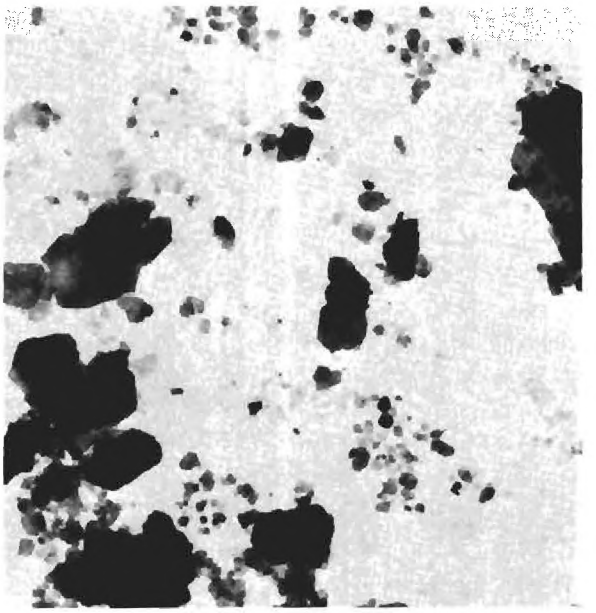
TEM 8300X

SAMPLE 00026

| SAMPLE 25 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 55" | $K_2O$ | 0.10 | % |
| Longitude: | 82° 37' 44" | CaO | 0.21 | |
| Northing: | 3672440 | MgO | 0.51 | |
| Easting: | 348150 | $Al_2O_3$ | 35.39 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.54 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.40 | |
| County: | Glascock | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 415' | $Fe_2O_3$ | 1.16 | |
| Overburden Thickness: | 82' | $P_2O_5$ | 0.032079 | |
| Ore Thickness: | 29' | F | 0.0057 | |

| SAMPLE 26 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 29" | $K_2O$ | 0.65 | % |
| Longitude: | 82° 35' 04" | CaO | 0.20 | |
| Northing: | 3671590 | MgO | 0.65 | |
| Easting: | 352270 | $Al_2O_3$ | 35.62 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.35 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.23 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 334' | $Fe_2O_3$ | 1.04 | |
| Overburden Thickness: | 38' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 40' | F | 0.0126 | |

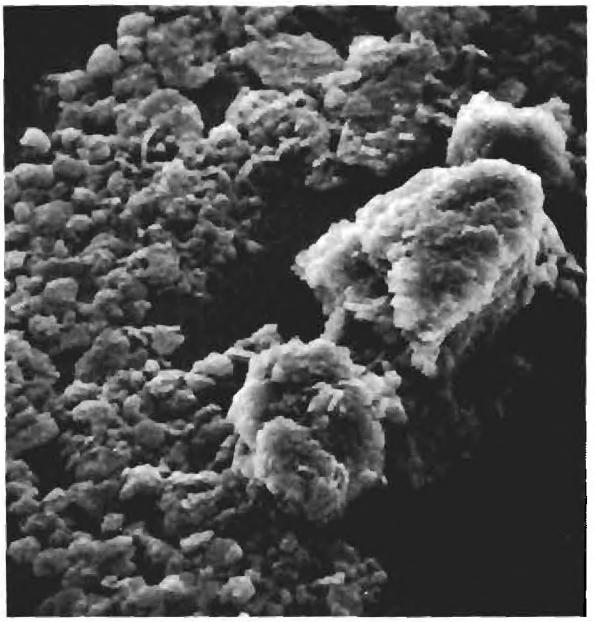


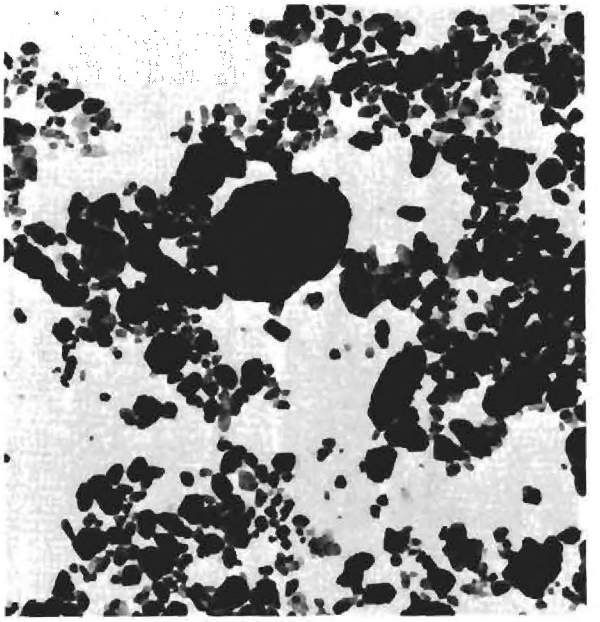


SEM 2000X

TEM 8300X

SAMPLE 00027





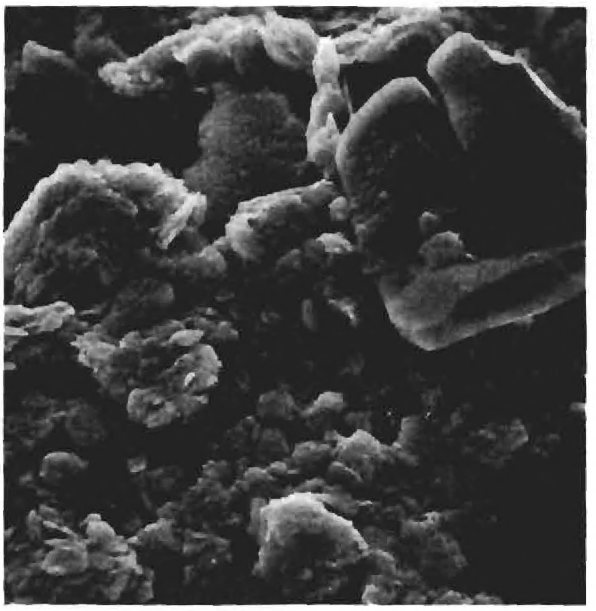
SEM 2000X

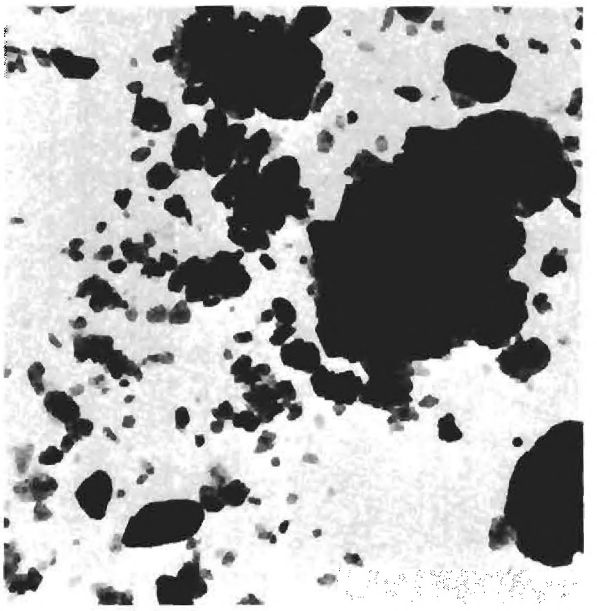
TEM 8300X

SAMPLE 00028

| SAMPLE 27 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 14' 47" | $K_2O$ | 0.87 | % |
| Longitude: | 82° 32' 22" | CaO | 0.13 | |
| Northing: | 3679460 | MgO | 0.71 | |
| Easting: | 356590 | $Al_2O_3$ | 34.88 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.76 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.97 | |
| County: | Glascock | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 399' | $Fe_2O_3$ | 0.67 | |
| Overburden Thickness: | 38' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 16' | F | 0.0072 | |

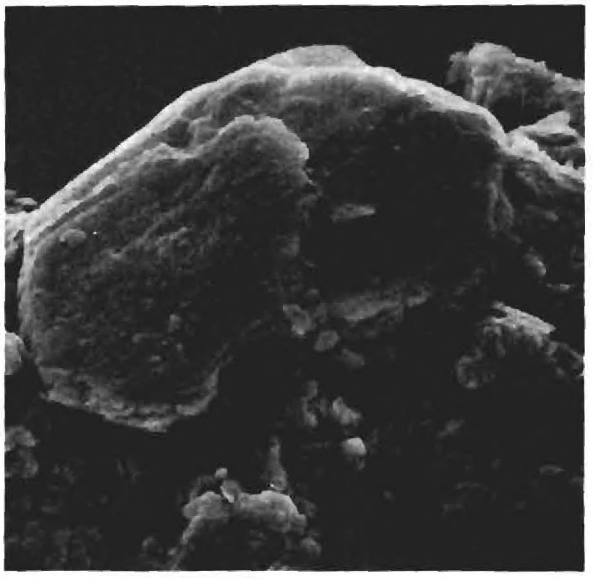
| SAMPLE 28 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 41" | $K_2O$ | 0.18 | % |
| Longitude: | 82° 31' 25" | CaO | 1.71 | |
| Northing: | 367740 | MgO | 1.58 | |
| Easting: | 358040 | $Al_2O_3$ | 35.60 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.50 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 2.74 | |
| County: | Glascock | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 409' | $Fe_2O_3$ | 1.00 | |
| Overburden Thickness: | 100' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 21' | F | 0.0042 | |

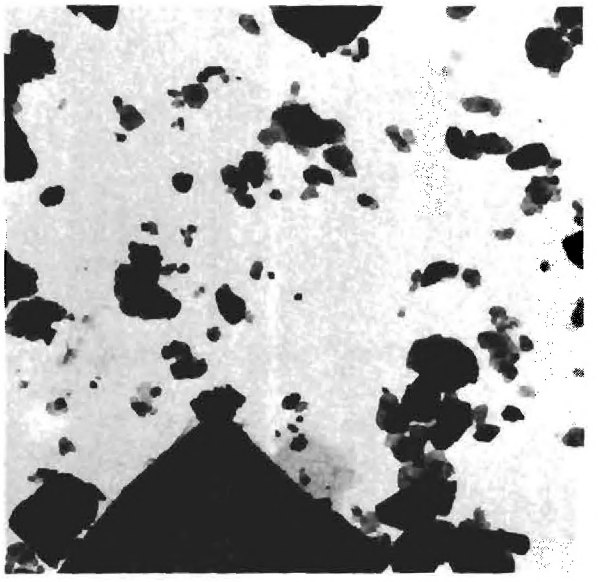




SEM 2000X TEM 8300X

SAMPLE 00029



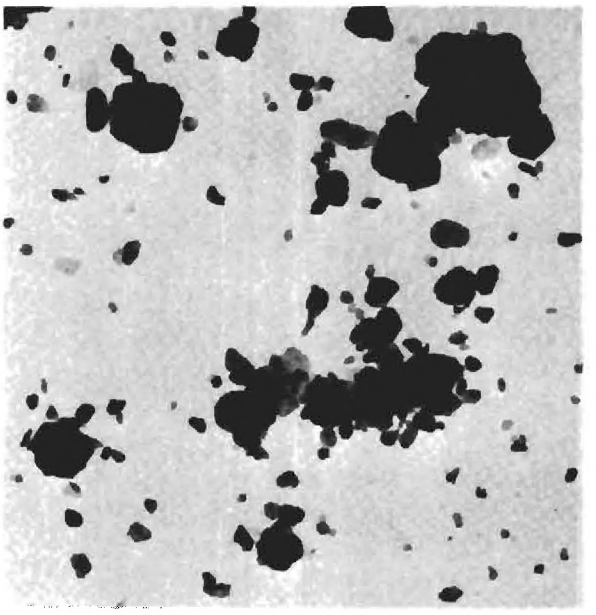


SEM 2000X TEM 8300X

SAMPLE 00030

| SAMPLE 29 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 09' 06" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 36' 55" | CaO | 1.43 | |
| Northing: | 3669080 | MgO | 1.31 | |
| Easting: | 349350 | $Al_2O_3$ | 35.65 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.30 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.78 | |
| County: | Glascock | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 451' | $Fe_2O_3$ | 0.77 | |
| Overburden Thickness: | 132' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 36' | F | 0.0055 | |

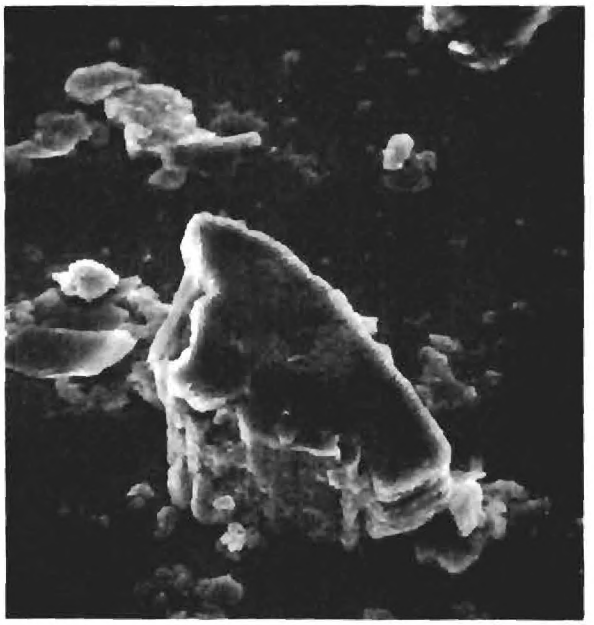
| SAMPLE 30 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 18' 43" | $K_2O$ | 0.34 | % |
| Longitude: | 82° 25' 12" | CaO | 1.62 | |
| Northing: | 3686590 | MgO | 1.29 | |
| Easting: | 367830 | $Al_2O_3$ | 36.15 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.78 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.55 | |
| County: | Warren | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 382' | $Fe_2O_3$ | 1.44 | |
| Overburden Thickness: | 54' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 42' | F | 0.0055 | |

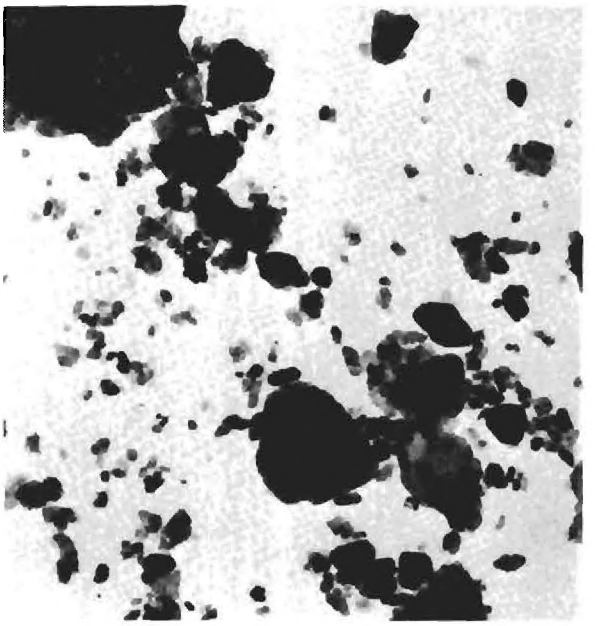


SEM 2000X

TEM 8300X

SAMPLE 00031





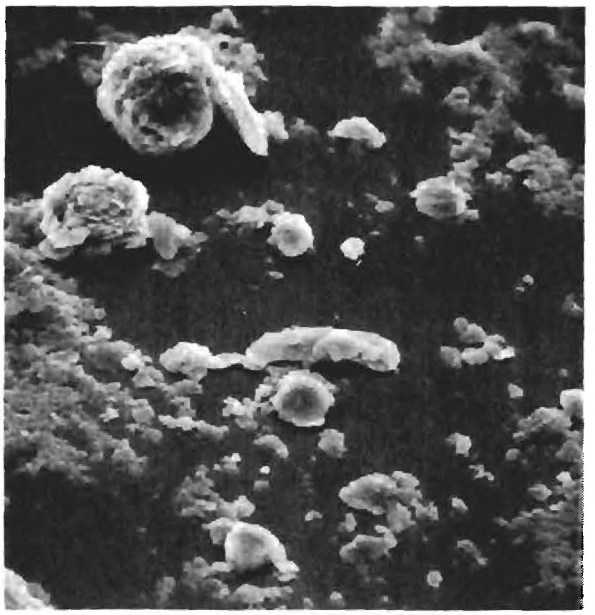
SEM 2000X

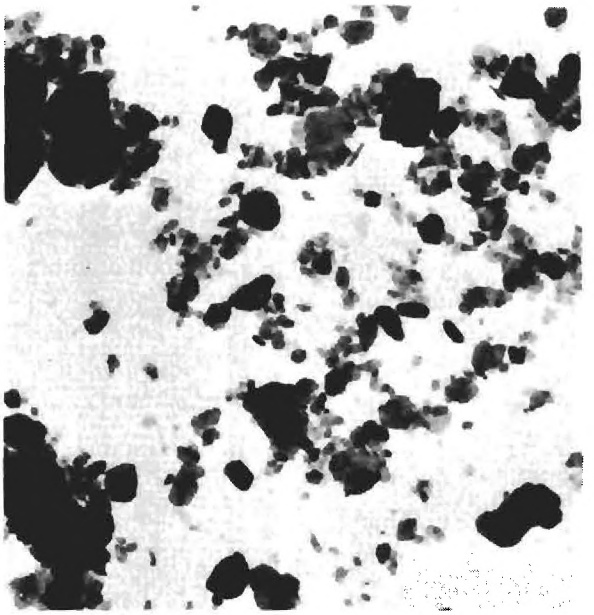
TEM 8300X

SAMPLE 00032

| SAMPLE 31 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 20" | $K_2O$ | 0.23 | % |
| Longitude: | 82° 29' 51" | CaO | 0.07 | |
| Northing: | 3691520 | MgO | 0.76 | |
| Easting: | 360670 | $Al_2O_3$ | 35.43 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.57 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.38 | |
| County: | McDuffie | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 471' | $Fe_2O_3$ | 1.16 | |
| Overburden Thickness: | 31' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 15' | F | 0.0055 | |

| SAMPLE 32 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 34" | $K_2O$ | 0.59 | % |
| Longitude: | 82° 22' 11" | CaO | 0.08 | |
| Northing: | 3689920 | MgO | 0.96 | |
| Easting: | 372540 | $Al_2O_3$ | 35.14 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.13 | |
| 1/24,000 Quadrangle: | Avondale | $TiO_2$ | 0.92 | |
| County: | McDuffie | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 469' | $Fe_2O_3$ | 1.10 | |
| Overburden Thickness: | 70' | $P_2O_5$ | 0.011457 | |
| Ore Thickness: | 25' | F | 0.0069 | |

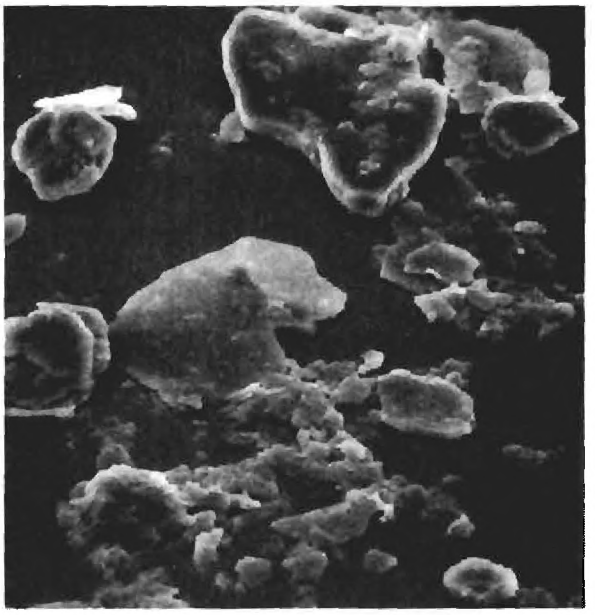


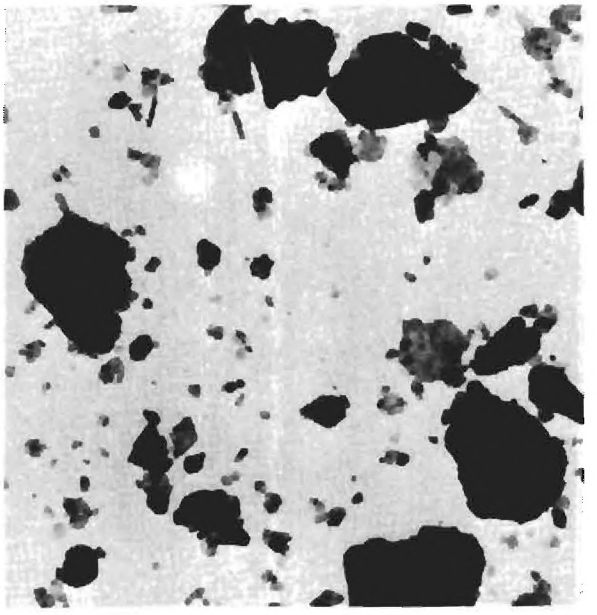


SEM 2000X

TEM 8300X

SAMPLE 00033





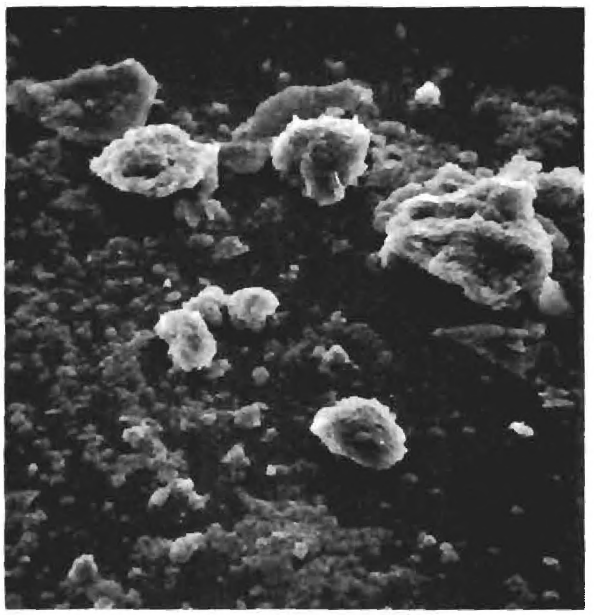
SEM 2000X

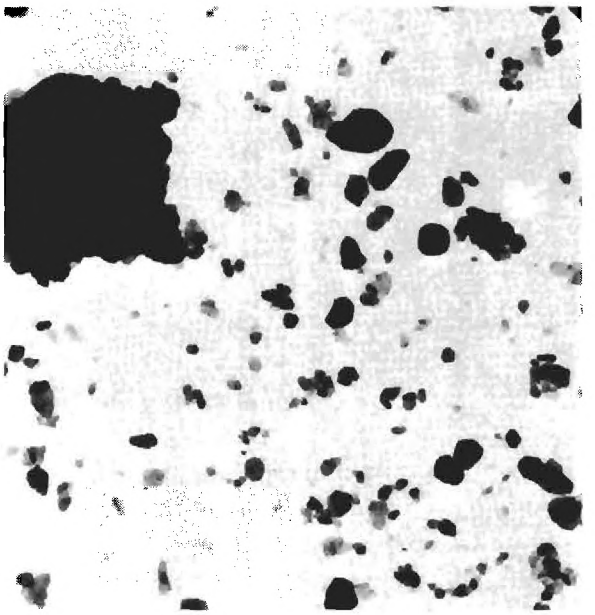
TEM 8300X

SAMPLE 00034

| SAMPLE 33 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 17' 44" | $K_2O$ | 0.10 | % |
| Longitude: | 82° 25' 33" | CaO | 0.07 | |
| Northing: | 3684780 | MgO | 0.95 | |
| Easting: | 367260 | $Al_2O_3$ | 33.92 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.97 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.18 | |
| County: | Warren | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 450' | $Fe_2O_3$ | 1.19 | |
| Overburden Thickness: | 90' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 22' | F | 0.0051 | |

| SAMPLE 34 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 17' 25" | $K_2O$ | 0.18 | % |
| Longitude: | 82° 24' 13" | CaO | 0.10 | |
| Northing: | 3684140 | MgO | 1.08 | |
| Easting: | 369300 | $Al_2O_3$ | 35.01 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.40 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.23 | |
| County: | Jefferson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 416' | $Fe_2O_3$ | 0.83 | |
| Overburden Thickness: | 63' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 28' | F | 0.0037 | |

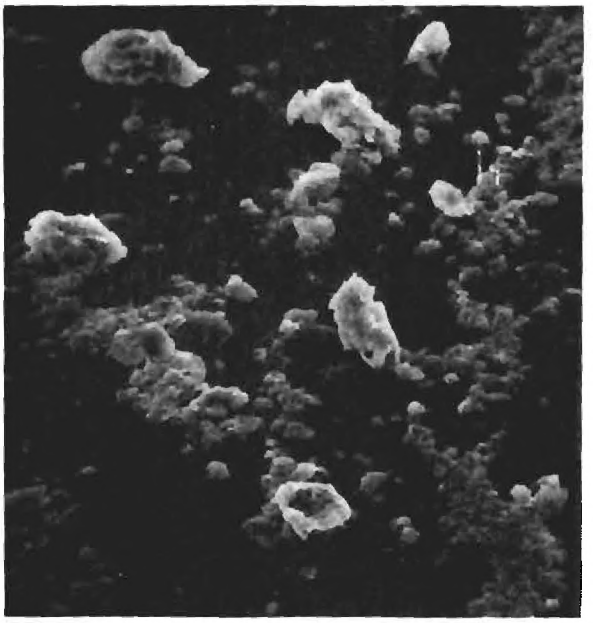


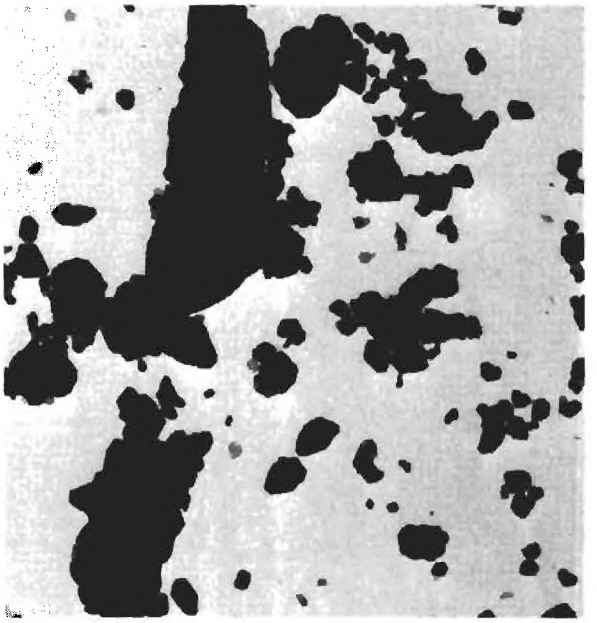


SEM 2000X

TEM 8300X

SAMPLE 00035





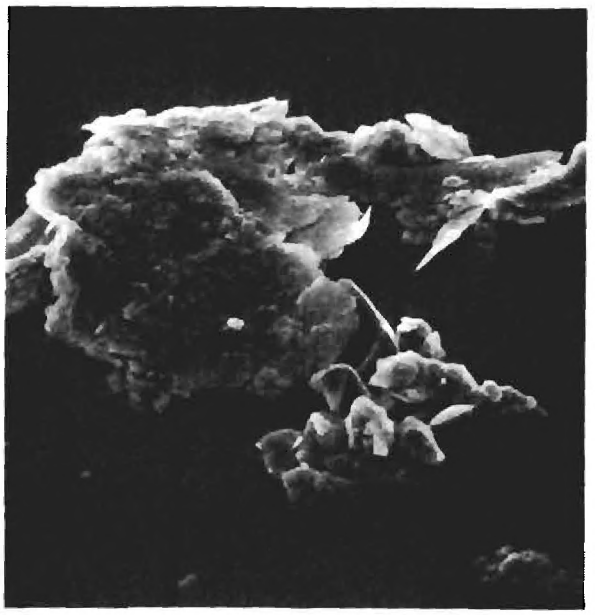
SEM 2000X

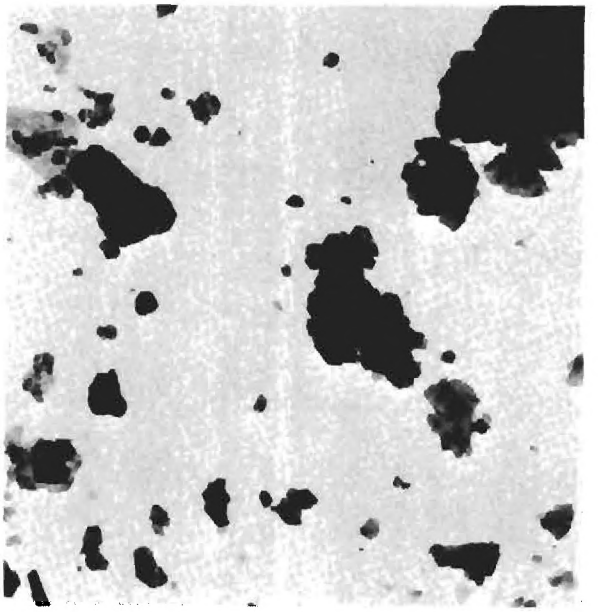
TEM 8300X

SAMPLE 00036

| SAMPLE 35 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 18' 24" | $K_2O$ | 0.10 | % |
| Longitude: | 82° 30' 11" | CaO | 0.06 | |
| Northing: | 3686100 | MgO | 0.76 | |
| Easting: | 360070 | $Al_2O_3$ | 34.37 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.79 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 0.85 | |
| County: | Warren | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 532' | $Fe_2O_3$ | 0.46 | |
| Overburden Thickness: | 112' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 18' | F | 0.0041 | |

| SAMPLE 36 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 21" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 23' 40" | CaO | 0.08 | |
| Northing: | 3689570 | MgO | 0.45 | |
| Easting: | 370270 | $Al_2O_3$ | 36.83 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.32 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.93 | |
| County: | McDuffie | $Cr_2O_3$ | 0.12 | |
| Surface Elevation: | 407' | $Fe_2O_3$ | 0.57 | |
| Overburden Thickness: | 36' | $P_2O_5$ | 0.000687 | |
| Ore Thickness: | 10' | F | 0.0061 | |

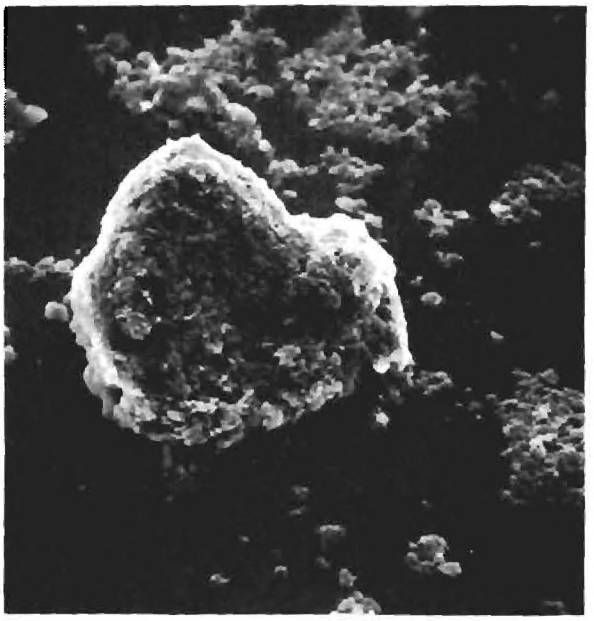


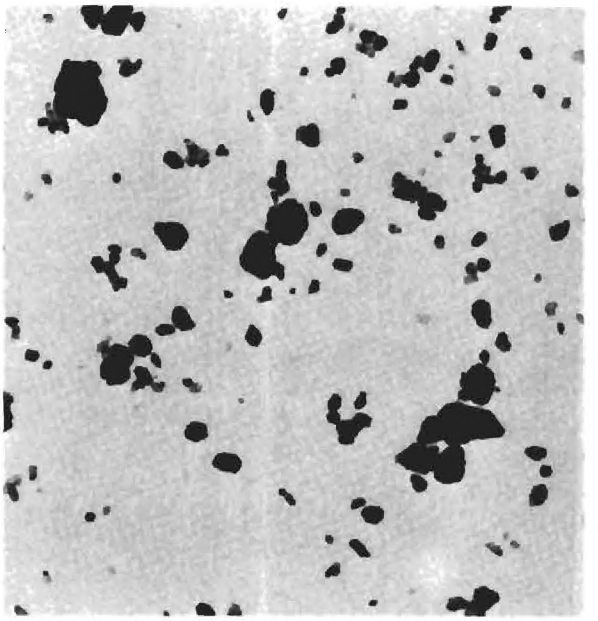


SEM 2000X

TEM 8300X

SAMPLE 00037





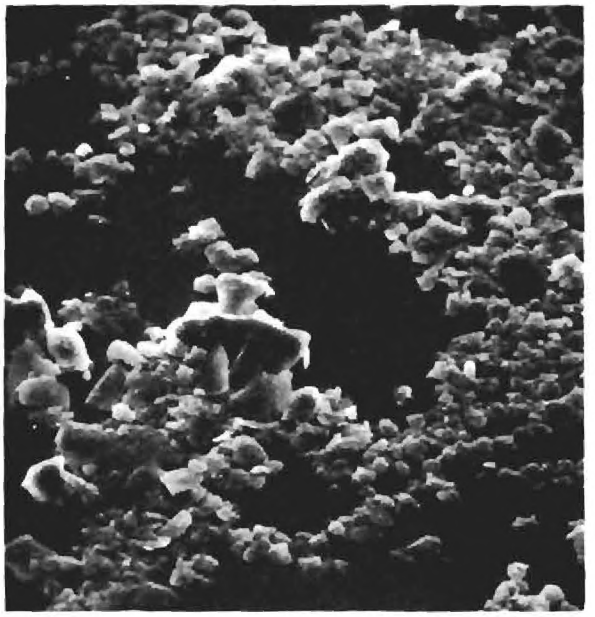
SEM 2000X

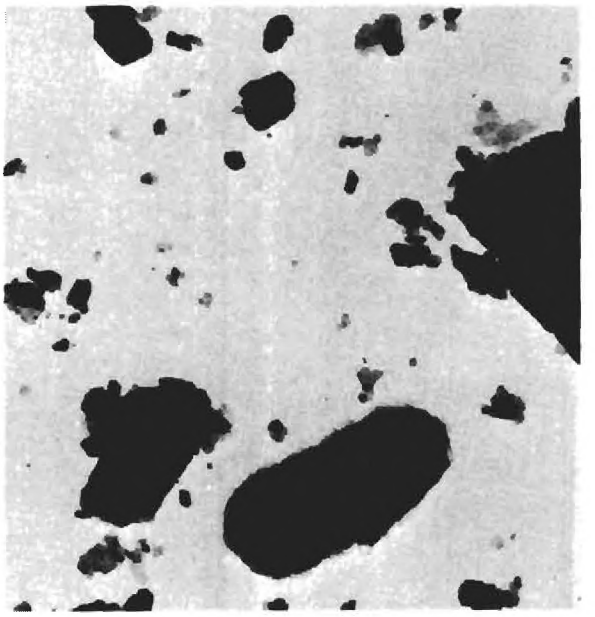
TEM 8300X

SAMPLE 00038

| SAMPLE 37 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 33" | $K_2O$ | 0.72 | % |
| Longitude: | 82° 23' 53" | CaO | 0.10 | |
| Northing: | 3689930 | MgO | 0.80 | |
| Easting: | 369910 | $Al_2O_3$ | 35.35 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.84 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.97 | |
| County: | McDuffie | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 439' | $Fe_2O_3$ | 2.70 | |
| Overburden Thickness: | 44' | $P_2O_5$ | 0.121442 | |
| Ore Thickness: | 30' | F | 0.0041 | |

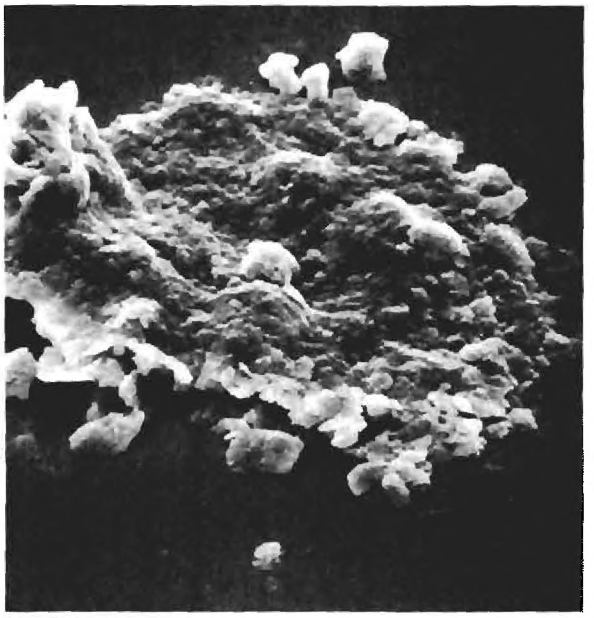
| SAMPLE 38 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 19' 25" | $K_2O$ | 0.23 | % |
| Longitude: | 82° 26' 27" | CaO | NA | |
| Northing: | 3687920 | MgO | 0.78 | |
| Easting: | 365920 | $Al_2O_3$ | 36.03 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.94 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 3.27 | |
| County: | Warren | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 439' | $Fe_2O_3$ | 1.24 | |
| Overburden Thickness: | 41' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 21' | F | 0.0048 | |

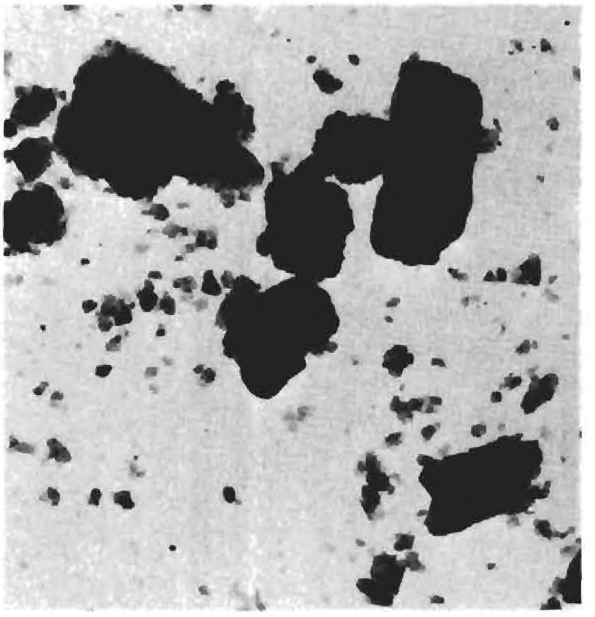




SEM 2000X TEM 8300X

SAMPLE 00039



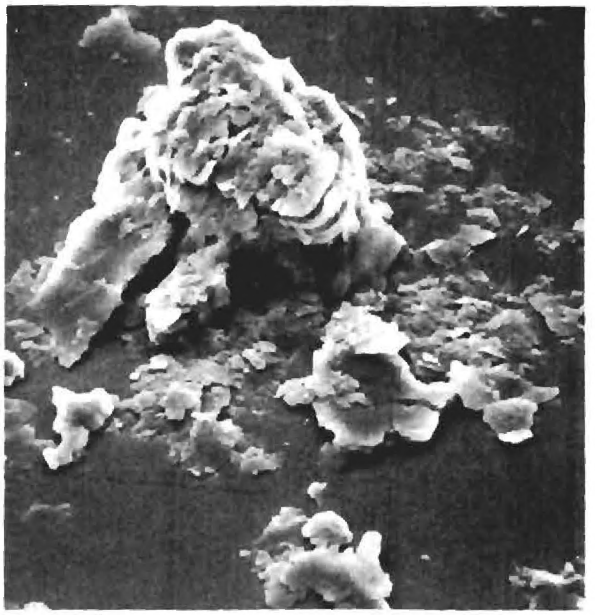


SEM 2000X TEM 8300X

SAMPLE 00040

| SAMPLE 39 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 09' 37" | $K_2O$ | 0.42 | % |
| Longitude: | 82° 41' 35" | CaO | 0.11 | |
| Northing: | 3670120 | MgO | 0.30 | |
| Easting: | 342100 | $Al_2O_3$ | 34.90 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.75 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.08 | |
| County: | Glascock | $Cr_2O_3$ | 0.19 | |
| Surface Elevation: | 370' | $Fe_2O_3$ | 1.27 | |
| Overburden Thickness: | 36' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 18' | F | 0.0081 | |

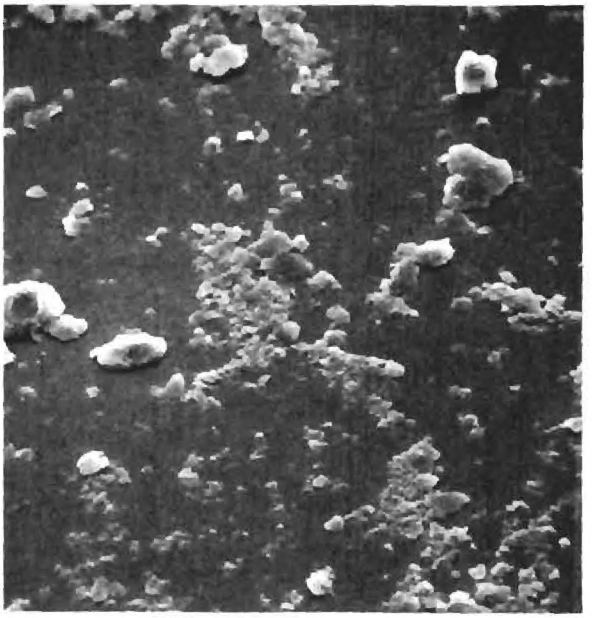
| SAMPLE 40 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 11" | $K_2O$ | 0.65 | % |
| Longitude: | 82° 40' 65" | CaO | 0.32 | |
| Northing: | 3671170 | MgO | 0.45 | |
| Easting: | 343160 | $Al_2O_3$ | 34.22 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.54 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.43 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 403' | $Fe_2O_3$ | 1.42 | |
| Overburden Thickness: | 96' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 20' | F | 0.0039 | |

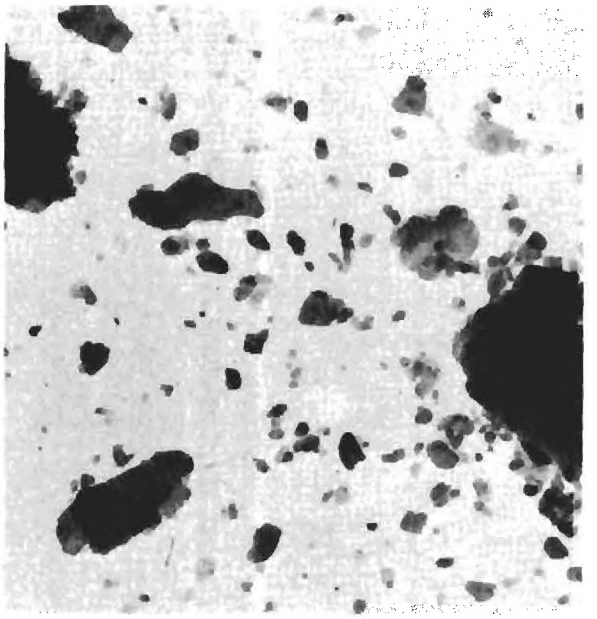


SEM 2000X

TEM 8300X

SAMPLE 00041





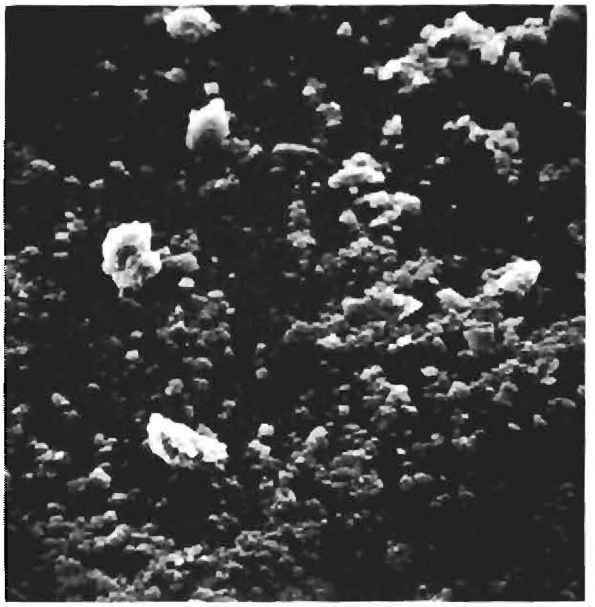
SEM 2000X

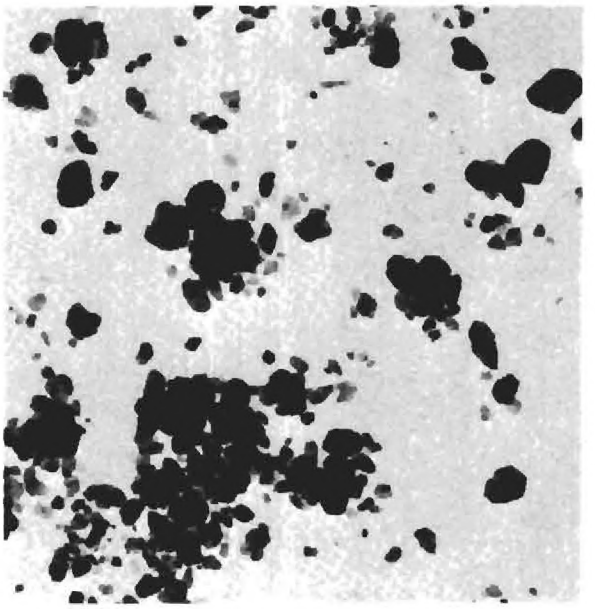
TEM 8300X

SAMPLE 00042

| SAMPLE 41 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 14' 48" | $K_2O$ | 0.24 | % |
| Longitude: | 82° 31' 40" | CaO | 0.08 | |
| Northing: | 3679500 | MgO | 0.28 | |
| Easting: | 357670 | $Al_2O_3$ | 36.07 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.15 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.92 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 434' | $Fe_2O_3$ | 0.71 | |
| Overburden Thickness: | 139' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 20' | F | 0.0091 | |

| SAMPLE 42 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 06' 30" | $K_2O$ | 0.20 | % |
| Longitude: | 82° 34' 51" | CaO | 0.25 | |
| Northing: | 3664230 | MgO | 0.45 | |
| Easting: | 352500 | $Al_2O_3$ | 35.81 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.59 | |
| 1/24,000 Quadrangle: | Grange | $TiO_2$ | 1.28 | |
| County: | Jefferson | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 327' | $Fe_2O_3$ | 0.97 | |
| Overburden Thickness: | 41' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 31' | F | 0.0082 | |

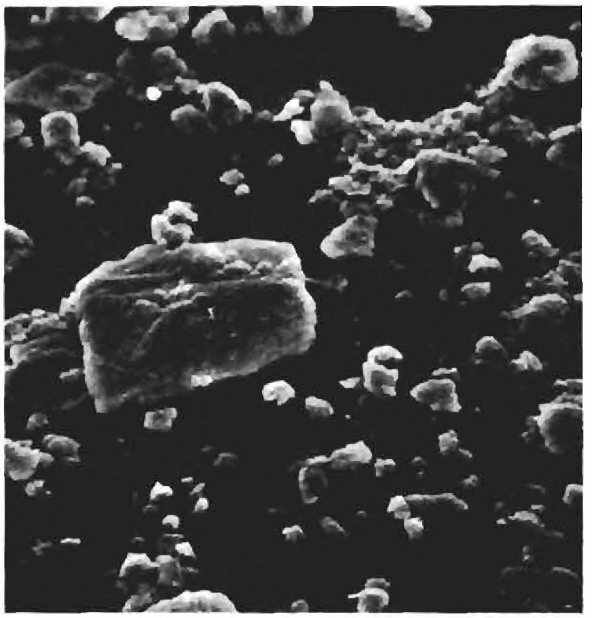


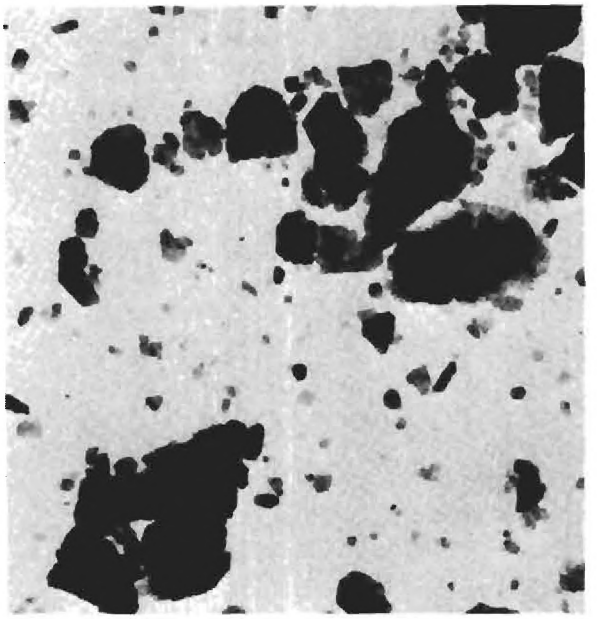


SEM 2000X

TEM 8300X

SAMPLE 00043





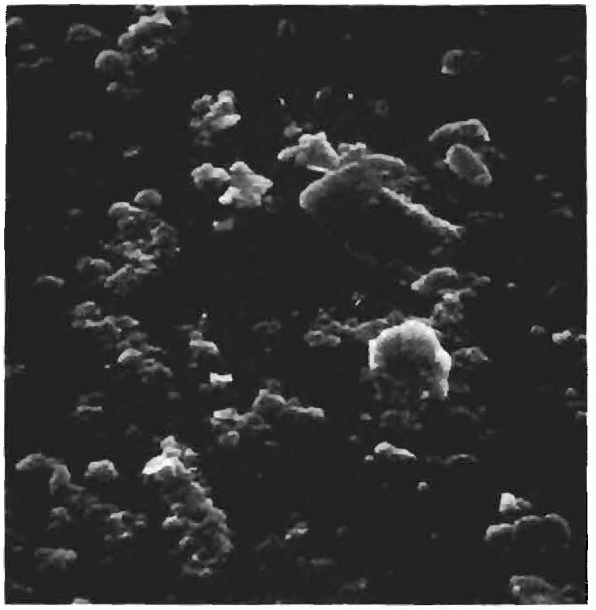
SEM 2000X

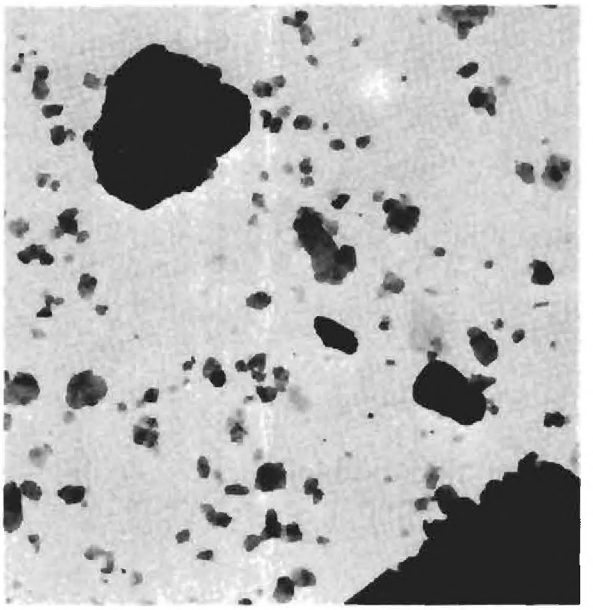
TEM 8300X

SAMPLE 00044

| SAMPLE 43 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 17' 59" | $K_2O$ | 0.47 | % |
| Longitude: | 82° 29' 08" | CaO | 0.15 | |
| Northing: | 3685340 | MgO | 0.65 | |
| Easting: | 361680 | $Al_2O_3$ | 36.22 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.24 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.45 | |
| County: | Warren | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 534' | $Fe_2O_3$ | 0.69 | |
| Overburden Thickness: | 126' | $P_2O_5$ | 0.011457 | |
| Ore Thickness: | 40' | F | 0.0055 | |

| SAMPLE 44 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 11' 35" | $K_2O$ | 0.95 | % |
| Longitude: | 82° 38' 38" | CaO | 0.31 | |
| Northing: | 3673680 | MgO | 0.81 | |
| Easting: | 346780 | $Al_2O_3$ | 36.49 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.40 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.40 | |
| County: | Glascock | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 450' | $Fe_2O_3$ | 0.97 | |
| Overburden Thickness: | 110' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 27' | F | 0.0036 | |

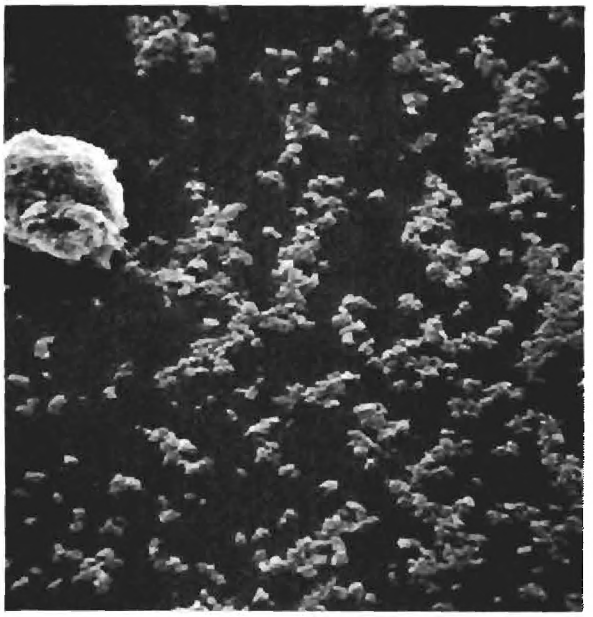


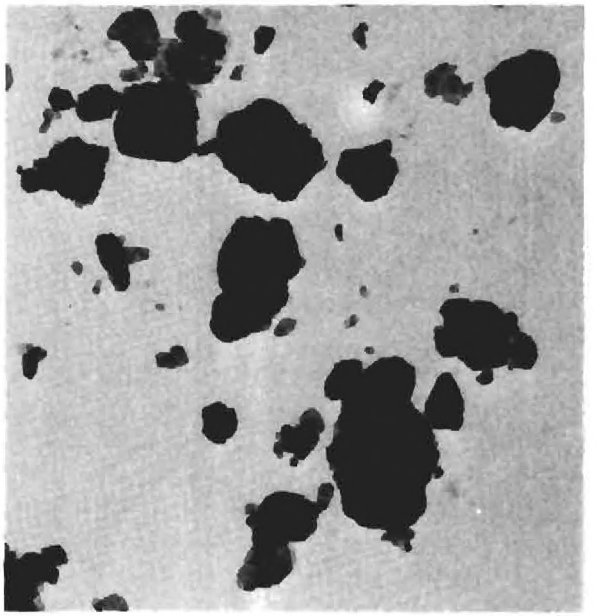


SEM 2000X

TEM 8300X

SAMPLE 00045





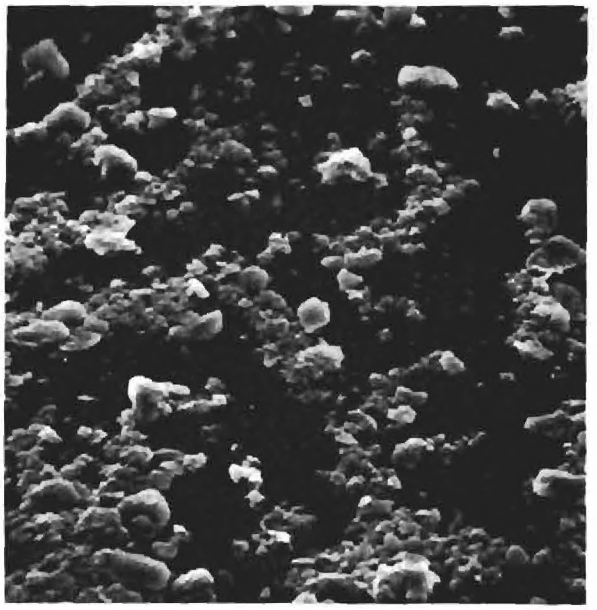
SEM 2000X

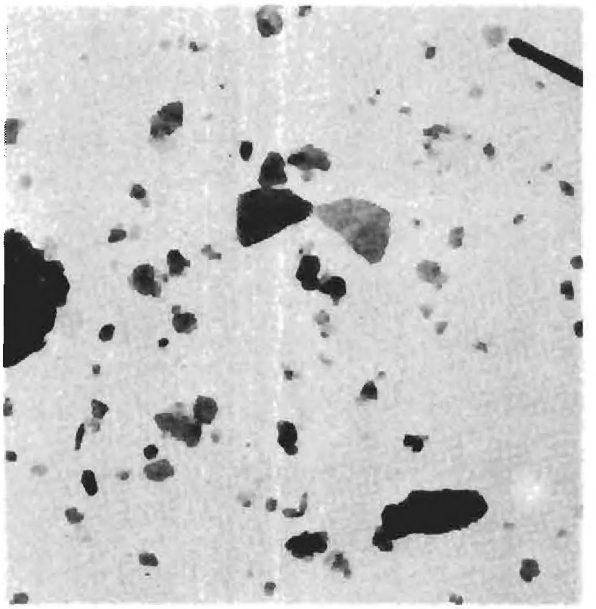
TEM 8300X

SAMPLE 00046

| SAMPLE 45 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 05' 29" | $K_2O$ | 0.33 | % |
| Longitude: | 82° 37' 47" | CaO | 1.57 | |
| Northing: | 3662410 | MgO | 1.43 | |
| Easting: | 347920 | $Al_2O_3$ | 35.84 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.42 | |
| 1/24,000 Quadrangle: | Downs | $TiO_2$ | 1.45 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 284' | $Fe_2O_3$ | 1.33 | |
| Overburden Thickness: | 46' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 32' | F | 0.0043 | |

| SAMPLE 46 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 22' 24" | $K_2O$ | 0.41 | % |
| Longitude: | 82° 26' 21" | CaO | 0.03 | |
| Northing: | 3694020 | MgO | 0.12 | |
| Easting: | 366120 | $Al_2O_3$ | 35.82 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.54 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.15 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 421' | $Fe_2O_3$ | 0.50 | |
| Overburden Thickness: | 17' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 19' | F | 0.0054 | |

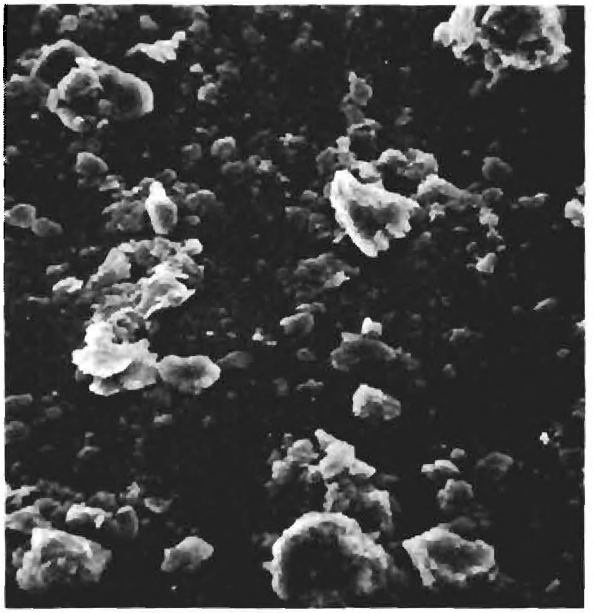


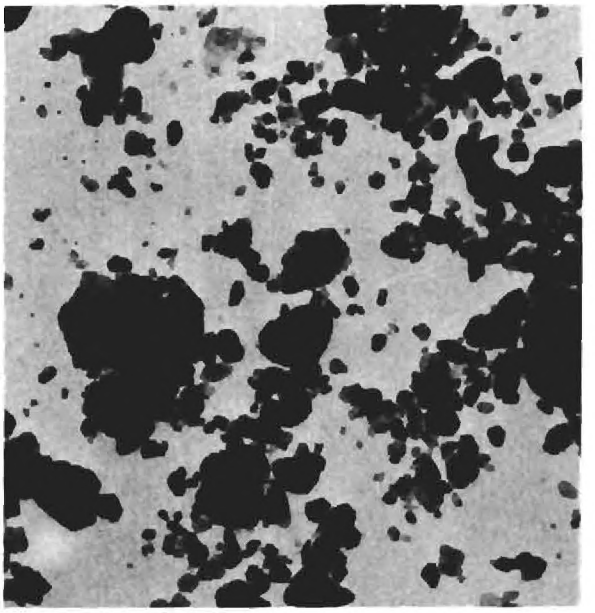


SEM 2000X

TEM 8300X

SAMPLE 00047





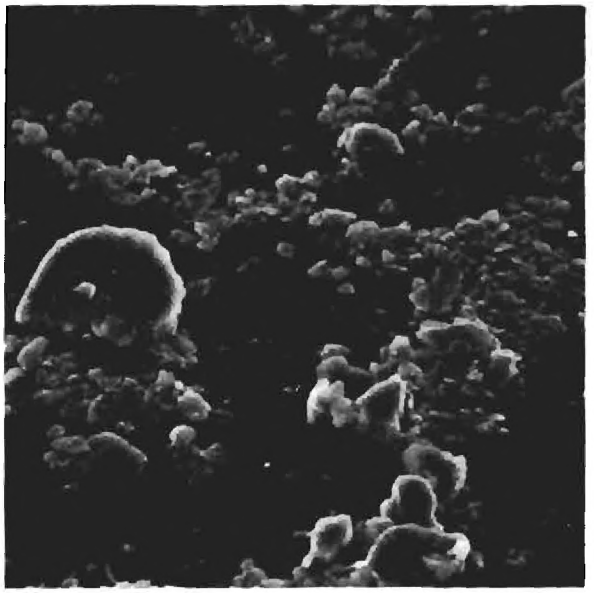
SEM 2000X

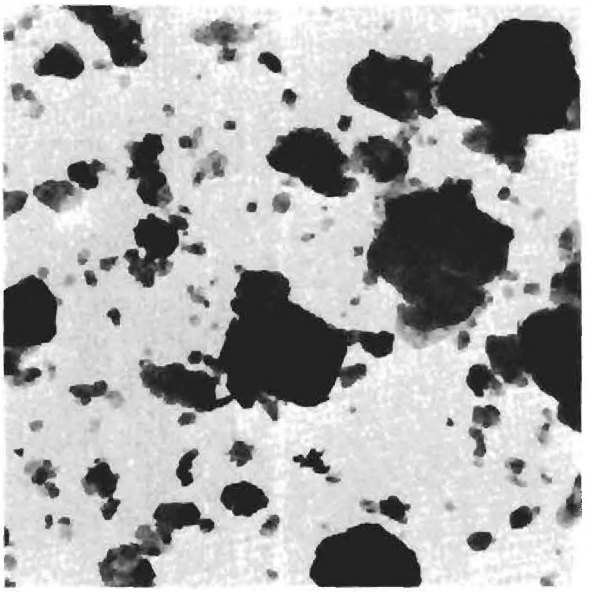
TEM 8300X

SAMPLE 00048

| SAMPLE 47 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 23" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 35' 44" | CaO | 0.10 | |
| Northing: | 3671430 | MgO | 0.56 | |
| Easting: | 351220 | $Al_2O_3$ | 33.97 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.25 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.85 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 278' | $Fe_2O_3$ | 0.71 | |
| Overburden Thickness: | 1' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 22' | F | 0.0042 | |

| SAMPLE 48 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 07' 47" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 34' 18" | CaO | 0.22 | |
| Northing: | 3666580 | MgO | 0.58 | |
| Easting: | 353390 | $Al_2O_3$ | 36.35 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.99 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.60 | |
| County: | Jefferson | $Cr_2O_3$ | 0.28 | |
| Surface Elevation: | 416' | $Fe_2O_3$ | 1.22 | |
| Overburden Thickness: | 151' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 44' | F | 0.0057 | |

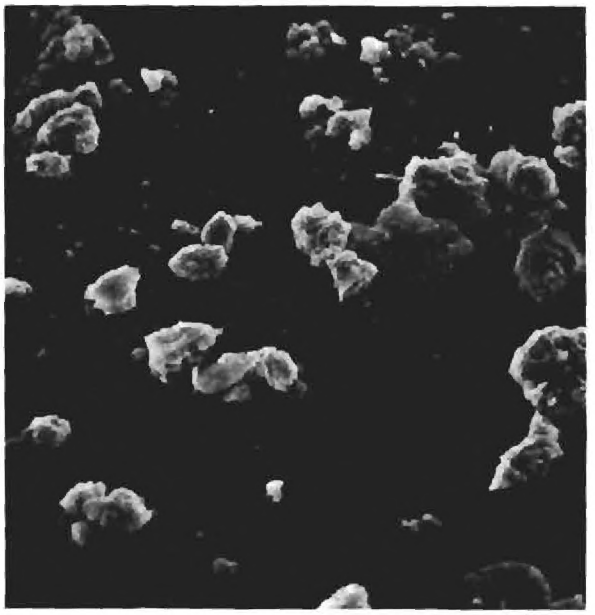


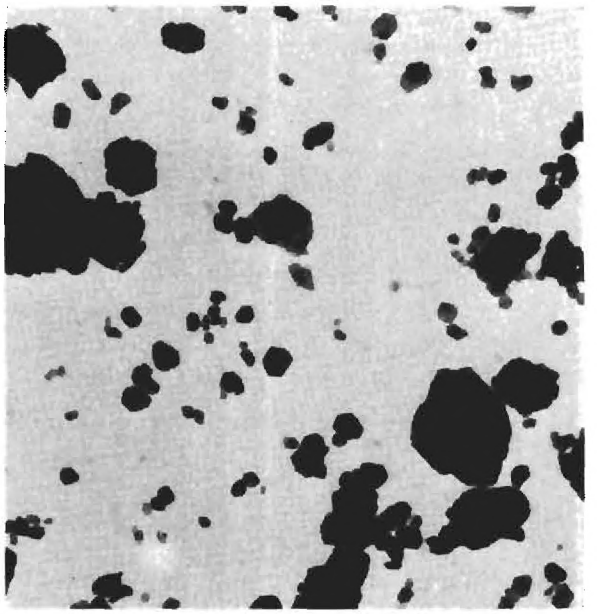


SEM 2000X

TEM 8300X

SAMPLE 00049





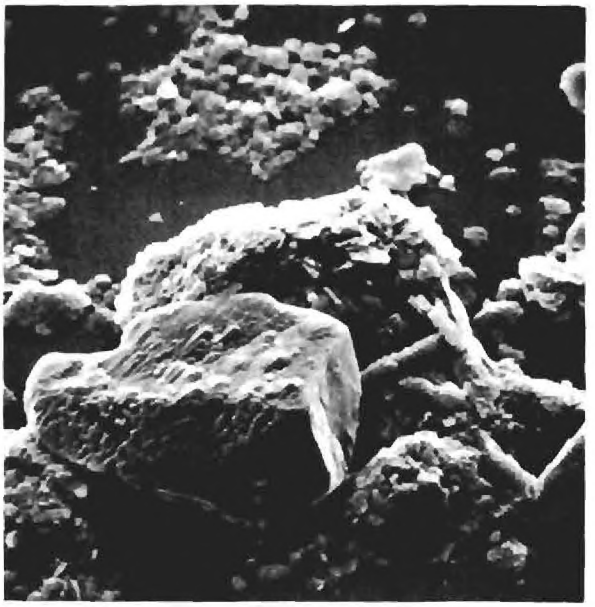
SEM 2000X

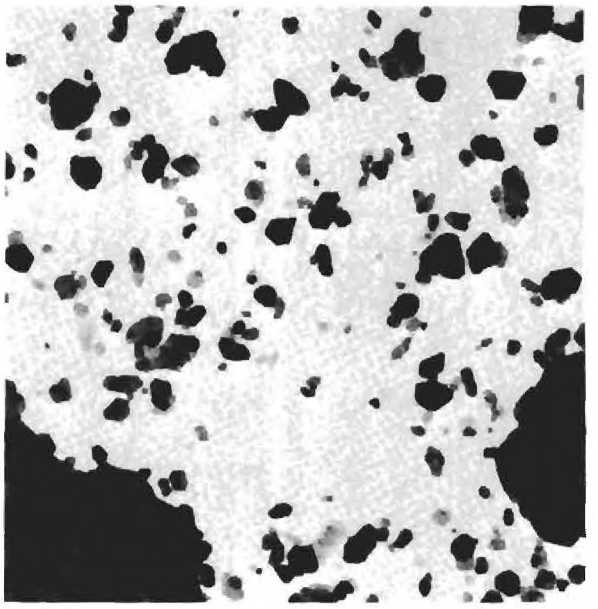
TEM 8300X

SAMPLE 00050

| SAMPLE 49 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 42" | $K_2O$ | 0.49 | % |
| Longitude: | 82° 23' 07" | CaO | 0.07 | |
| Northing: | 3690190 | MgO | 0.15 | |
| Easting: | 371110 | $Al_2O_3$ | 34.39 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.55 | |
| 1/24,000 Quadrangle: | Bowdens Mill | $TiO_2$ | 1.13 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 514' | $Fe_2O_3$ | 0.94 | |
| Overburden Thickness: | 54' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 40' | F | 0.0035 | |

| SAMPLE 50 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 20' 41" | $K_2O$ | 0.58 | % |
| Longitude: | 82° 22' 52" | CaO | 0.31 | |
| Northing: | 3690170 | MgO | 0.25 | |
| Easting: | 371480 | $Al_2O_3$ | 35.24 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.03 | |
| 1/24,000 Quadrangle: | Bowdens Mill | $TiO_2$ | 1.13 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 490' | $Fe_2O_3$ | 0.76 | |
| Overburden Thickness: | 52' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 39' | F | 0.0028 | |

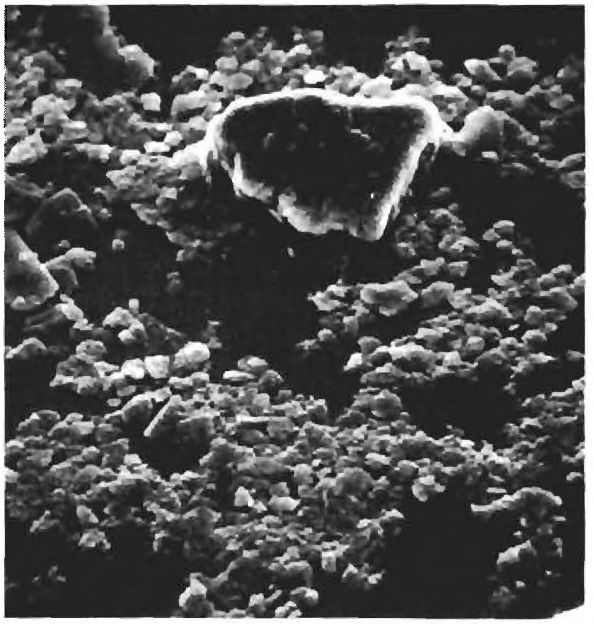


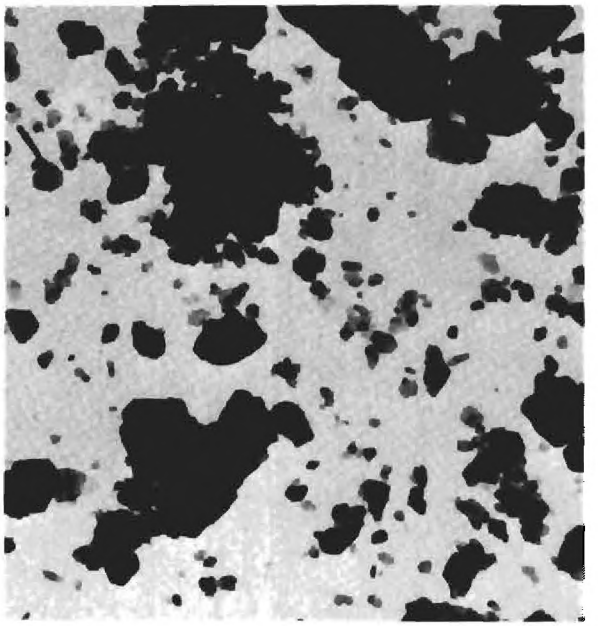


SEM 2000X

TEM 8300X

SAMPLE 00051





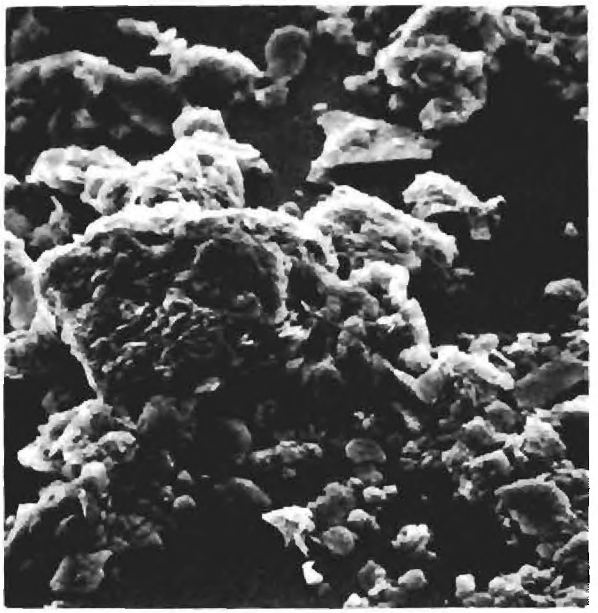
SEM 2000X

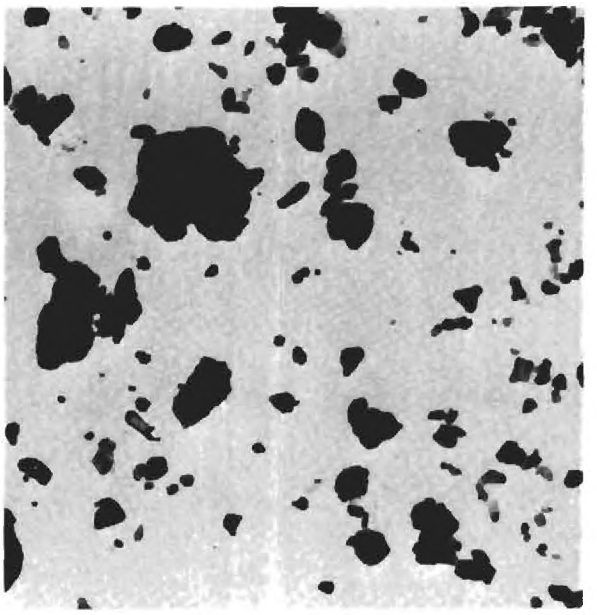
TEM 8300X

SAMPLE 00052

| SAMPLE 51 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 18" | $K_2O$ | 0.33 | % |
| Longitude: | 82° 31' 13" | CaO | 0.14 | |
| Northing: | 3680400 | MgO | 0.18 | |
| Easting: | 358390 | $Al_2O_3$ | 35.48 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.97 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 1.35 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 479' | $Fe_2O_3$ | 0.71 | |
| Overburden Thickness: | 128' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 20' | F | 0.0042 | |

| SAMPLE 52 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 17' 00" | $K_2O$ | 0.36 | % |
| Longitude: | 82° 26' 06" | CaO | 0.14 | |
| Northing: | 3683444 | MgO | 0.25 | |
| Easting: | 366390 | $Al_2O_3$ | 35.86 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.71 | |
| 1/24,000 Quadrangle: | Bowdens Mill | $TiO_2$ | 1.30 | |
| County: | Warren | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 384' | $Fe_2O_3$ | 1.44 | |
| Overburden Thickness: | 30' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 38' | F | 0.0021 | |

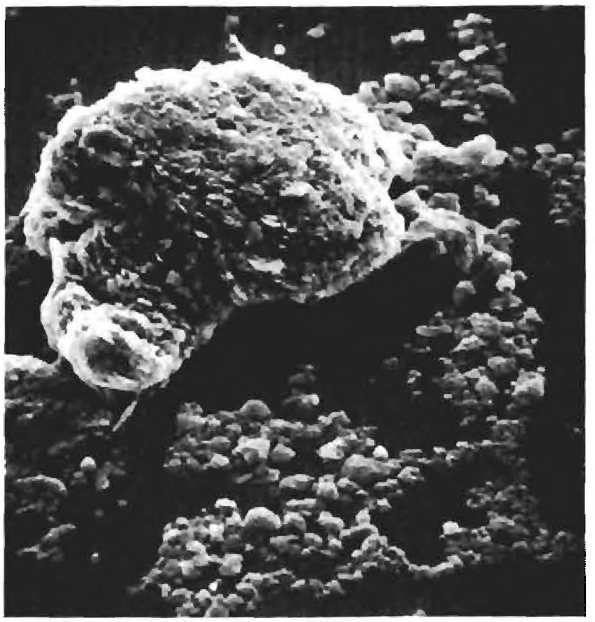


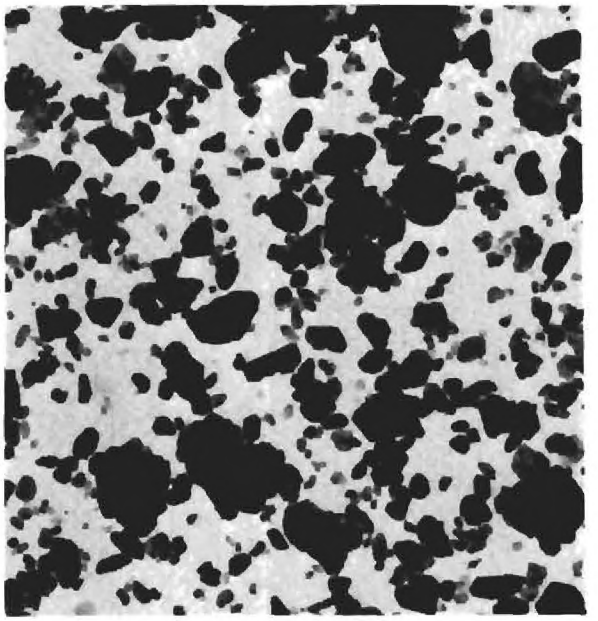


SEM 2000X

TEM 8300X

SAMPLE 00053





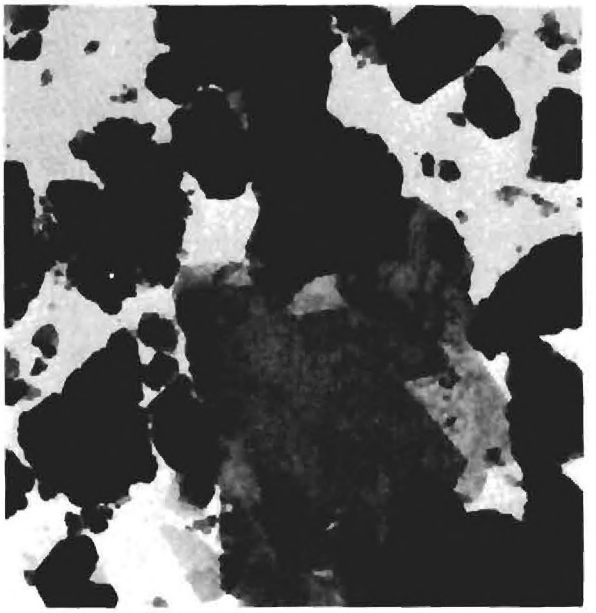
SEM 2000X

TEM 8300X

SAMPLE 00054

| SAMPLE 53 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 09' 37" | $K_2O$ | 0.06 | % |
| Longitude: | 82° 33' 09" | CaO | 0.06 | |
| Northing: | 3669930 | MgO | 0.20 | |
| Easting: | 355230 | $Al_2O_3$ | 35.60 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.20 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.12 | |
| County: | Jefferson | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 324' | $Fe_2O_3$ | 1.12 | |
| Overburden Thickness: | 108' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 28' | F | 0.0044 | |

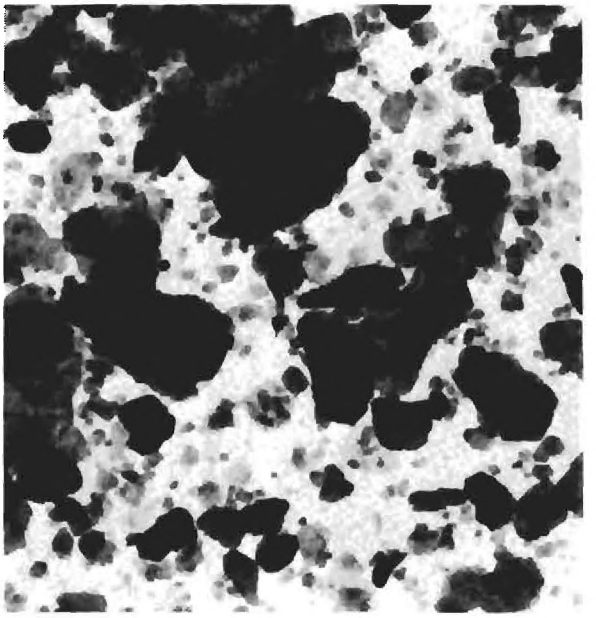
| SAMPLE 54 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 08' 30" | $K_2O$ | 0.31 | % |
| Longitude: | 82° 33' 24" | CaO | 0.17 | |
| Northing: | 3667890 | MgO | 0.78 | |
| Easting: | 354800 | $Al_2O_3$ | 35.82 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.88 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 2.04 | |
| County: | Jefferson | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 405' | $Fe_2O_3$ | 1.33 | |
| Overburden Thickness: | 147' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 33' | F | 0.0032 | |



SEM 2000X

TEM 8300X

SAMPLE 00055



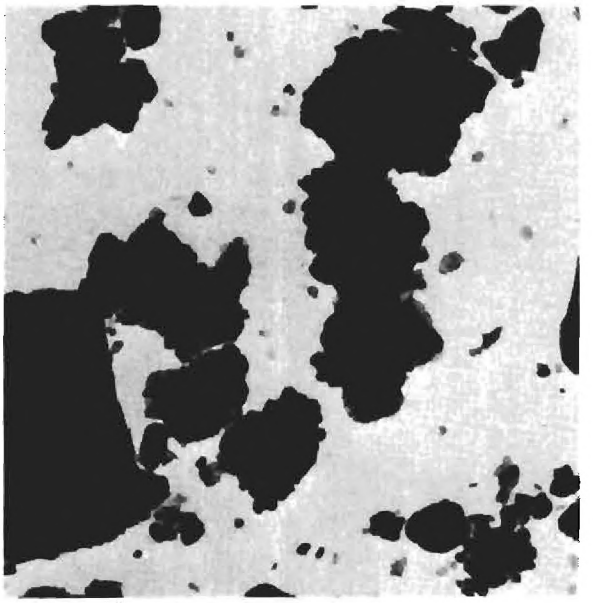
SEM 2000X

TEM 8300X

SAMPLE 00056

| SAMPLE 55 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 30" | $K_2O$ | 0.65 | % |
| Longitude: | 82° 32' 51" | CaO | 0.13 | |
| Northing: | 3680820 | MgO | 0.53 | |
| Easting: | 355850 | $Al_2O_3$ | 36.07 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.07 | |
| 1/24,000 Quadrangle: | Bastonville | $TiO_2$ | 0.88 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 367' | $Fe_2O_3$ | 1.30 | |
| Overburden Thickness: | 18' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 5' | F | 0.0026 | |

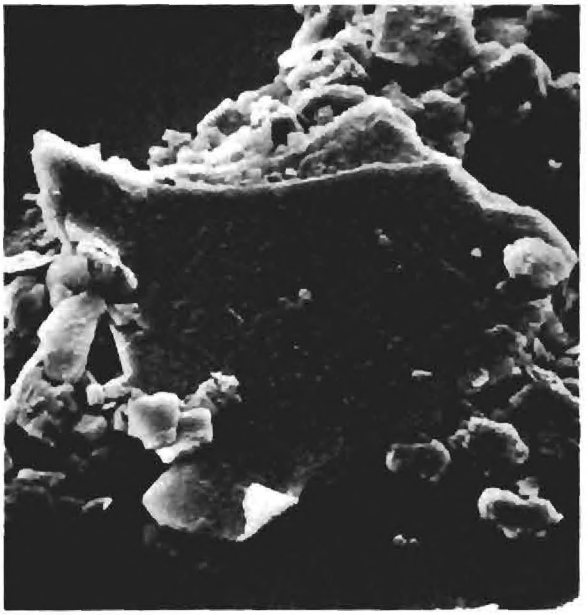
| SAMPLE 56 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 41" | $K_2O$ | 0.33 | % |
| Longitude: | 82° 29' 29" | CaO | 0.08 | |
| Northing: | 3681050 | MgO | 1.72 | |
| Easting: | 361090 | $Al_2O_3$ | 34.60 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.26 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.90 | |
| County: | Glascock | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 492' | $Fe_2O_3$ | 0.59 | |
| Overburden Thickness: | 136' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 36' | F | 0.0035 | |

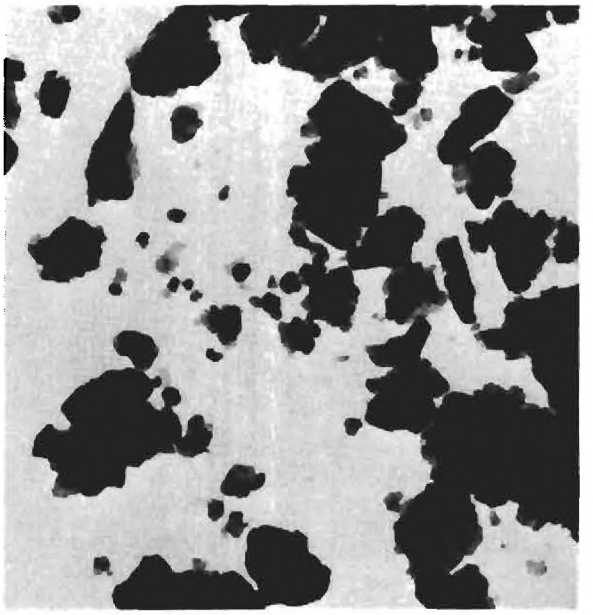


SEM 2000X

TEM 8300X

SAMPLE 00057





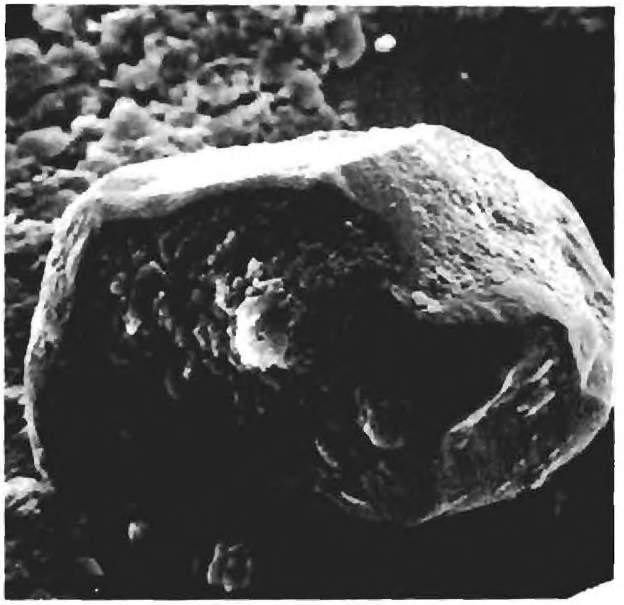
SEM 2000X

TEM 8300X

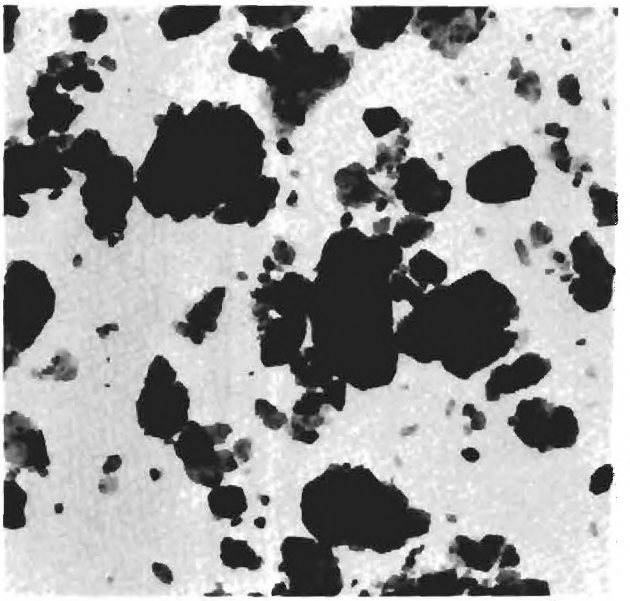
SAMPLE 00058

| SAMPLE 57 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 23' 54" | $K_2O$ | 0.10 | % |
| Longitude: | 82° 24' 42" | CaO | 0.03 | |
| Northing: | 3695240 | MgO | 0.33 | |
| Easting: | 368390 | $Al_2O_3$ | 34.61 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.83 | |
| 1/24,000 Quadrangle: | Dearing | $TiO_2$ | 0.55 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 464' | $Fe_2O_3$ | 0.41 | |
| Overburden Thickness: | 35' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 5' | F | 0.0021 | |

| SAMPLE 58 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 48" | $K_2O$ | 0.67 | % |
| Longitude: | 82° 24' 38" | CaO | 0.22 | |
| Northing: | 3692260 | MgO | 0.15 | |
| Easting: | 368800 | $Al_2O_3$ | 34.96 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.94 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 0.95 | |
| County: | McDuffie | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 407' | $Fe_2O_3$ | 1.12 | |
| Overburden Thickness: | 12' | $P_2O_5$ | 0.011457 | |
| Ore Thickness: | 19' | F | 0.0026 | |

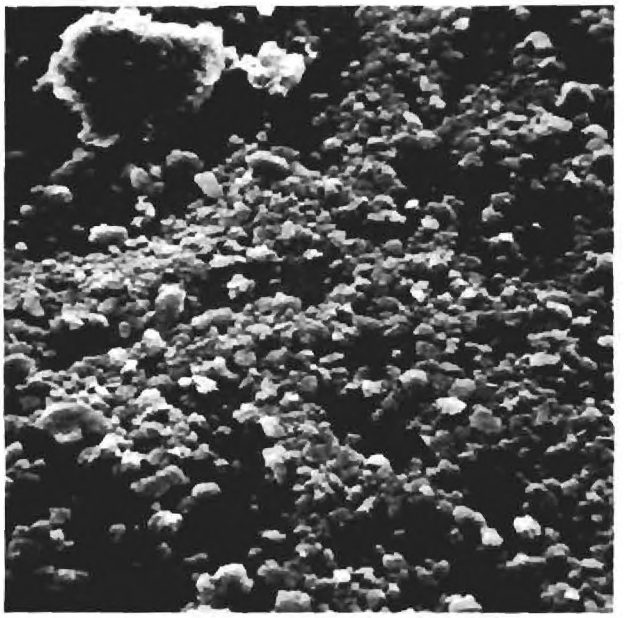


SEM 2000X

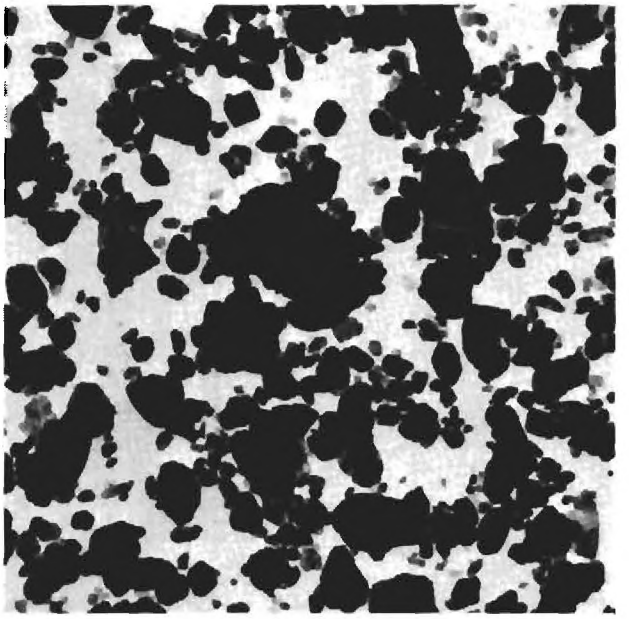


TEM 8300X

SAMPLE 00059



SEM 2000X

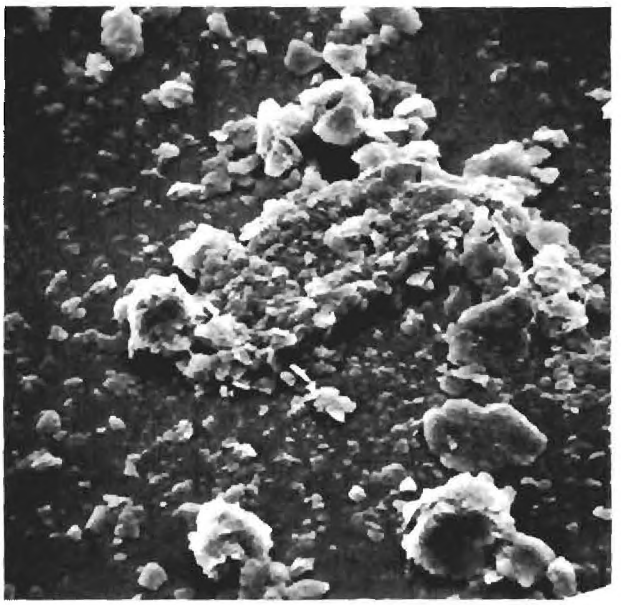


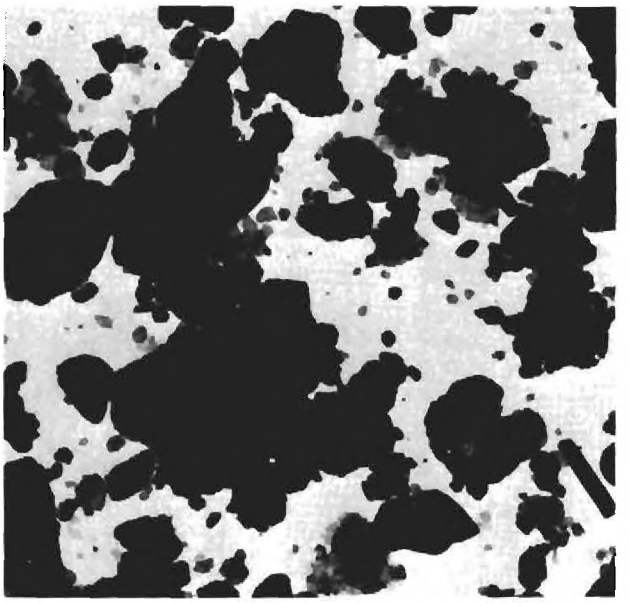
TEM 8300X

SAMPLE 00060

| SAMPLE 59 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 13" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 31' 35" | CaO | 0.06 | |
| Northing: | 3676570 | MgO | 0.20 | |
| Easting: | 357780 | $Al_2O_3$ | 35.86 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 52.88 | |
| 1/24,000 Quadrangle: | Wrens | $TiO_2$ | 0.58 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 452' | $Fe_2O_3$ | 0.46 | |
| Overburden Thickness: | 144' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 23' | F | 0.0025 | |

| SAMPLE 60 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 11' 42" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 34' 18" | CaO | 0.39 | |
| Northing: | 3673830 | MgO | 0.15 | |
| Easting: | 353490 | $Al_2O_3$ | 35.13 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 50.02 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.27 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 335' | $Fe_2O_3$ | 1.22 | |
| Overburden Thickness: | 31' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 27' | F | 0.0048 | |

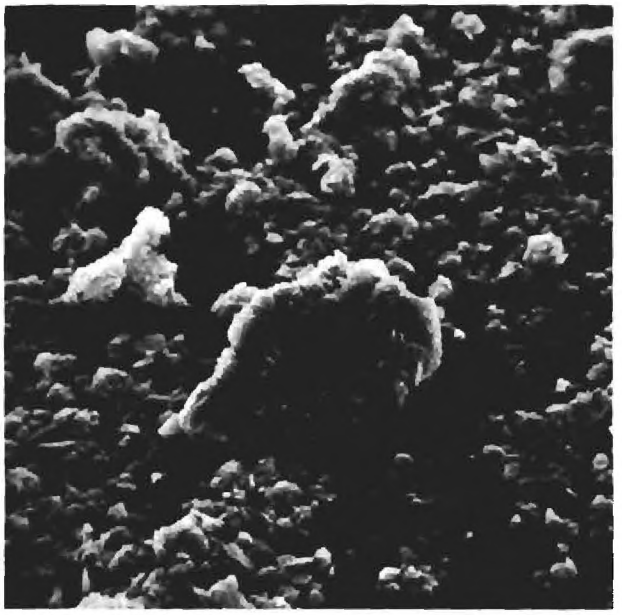


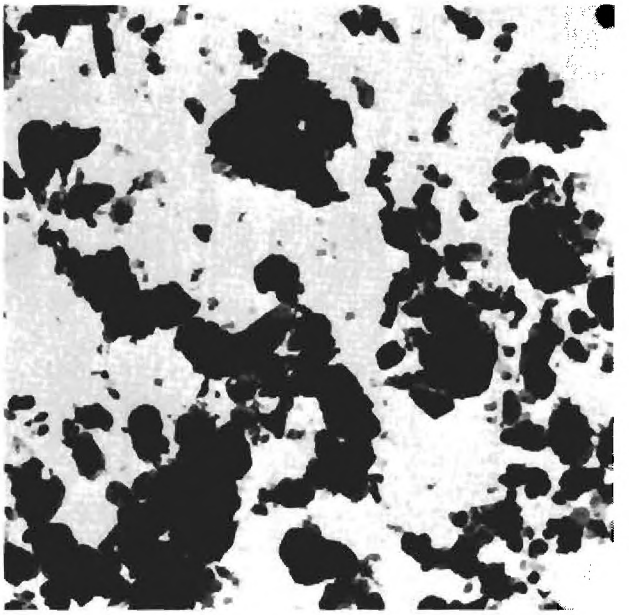


SEM 2000X

TEM 8300X

SAMPLE 00061





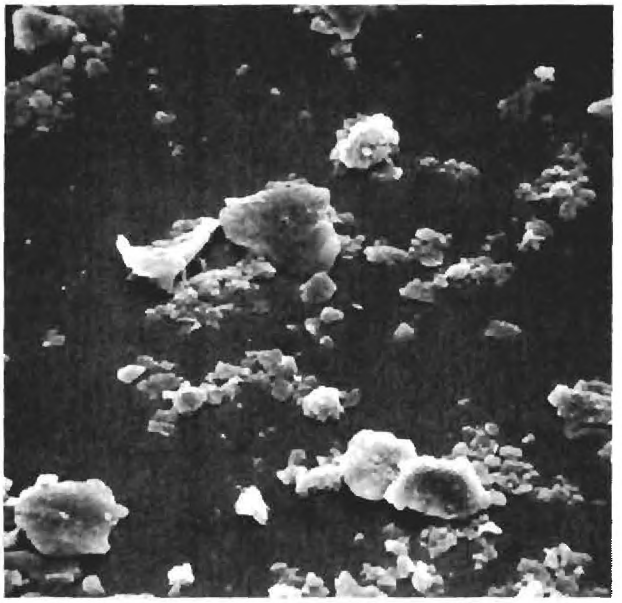
SEM 2000X

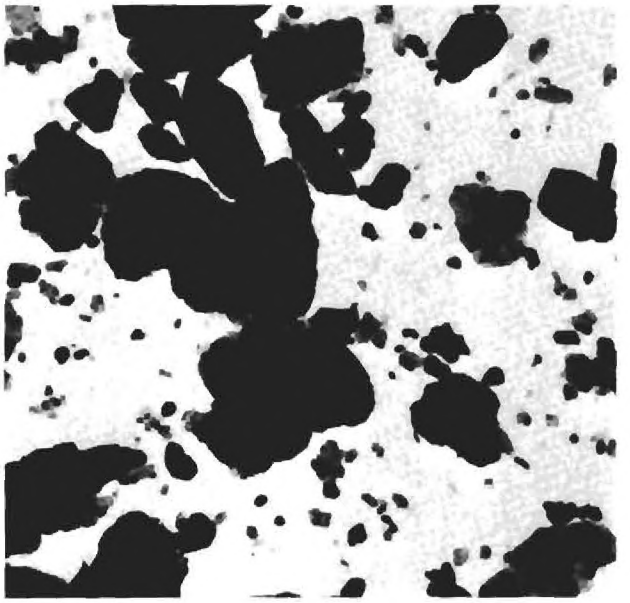
TEM 8300X

SAMPLE 00062

| SAMPLE 61 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 13' 05" | $K_2O$ | 0.05 | % |
| Longitude: | 82° 37' 23" | CaO | 0.04 | |
| Northing: | 3676430 | MgO | 0.23 | |
| Easting: | 348720 | $Al_2O_3$ | 34.99 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.83 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.20 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 330' | $Fe_2O_3$ | 0.43 | |
| Overburden Thickness: | 5' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 23' | F | 0.0036 | |

| SAMPLE 62 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 11' 54" | $K_2O$ | 0.88 | % |
| Longitude: | 82° 33' 33" | CaO | 0.03 | |
| Northing: | 3674190 | MgO | 0.15 | |
| Easting: | 354050 | $Al_2O_3$ | 34.99 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.86 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.08 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 357' | $Fe_2O_3$ | 0.46 | |
| Overburden Thickness: | 65' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 38' | F | 0.0038 | |

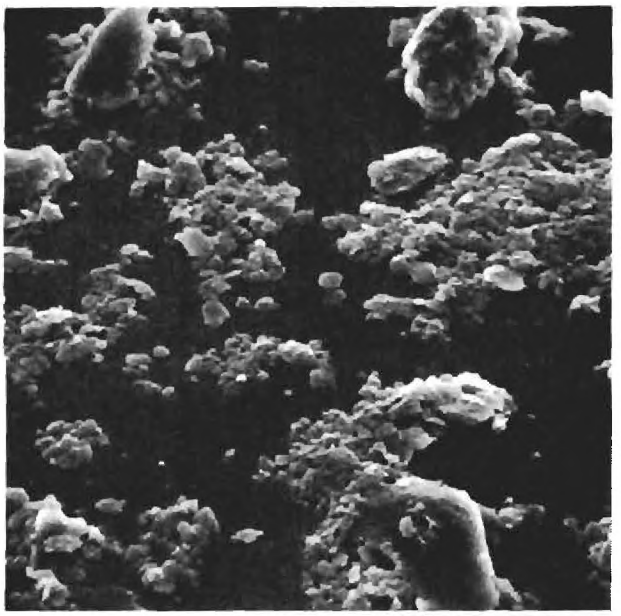


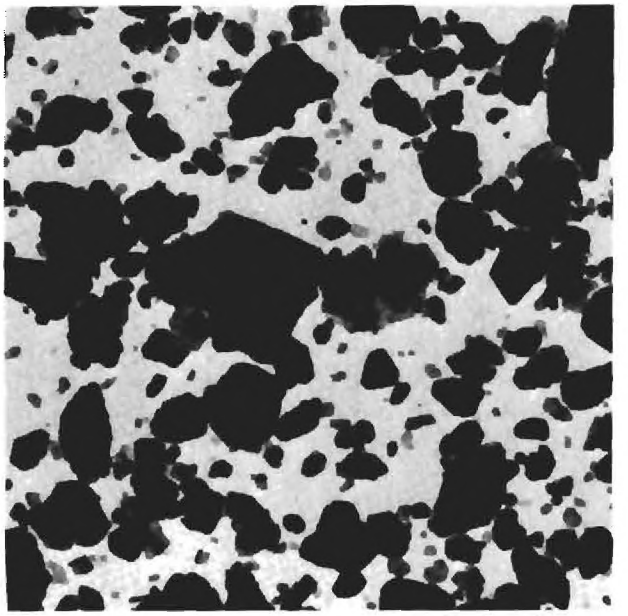


SEM 2000X

TEM 8300X

SAMPLE 00063





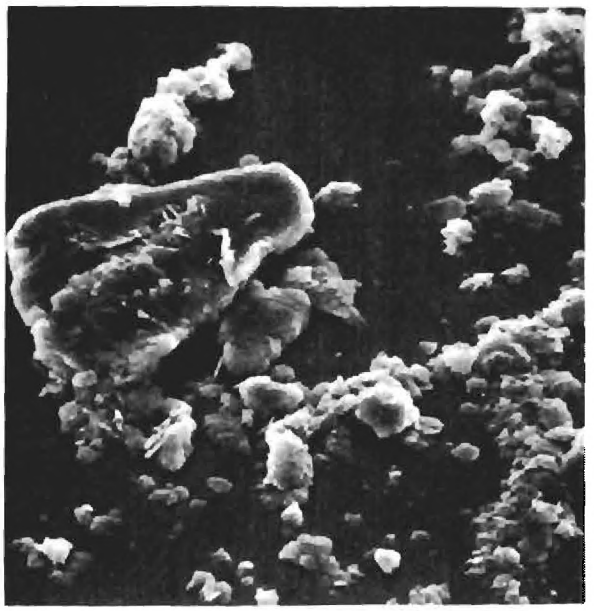
SEM 2000X

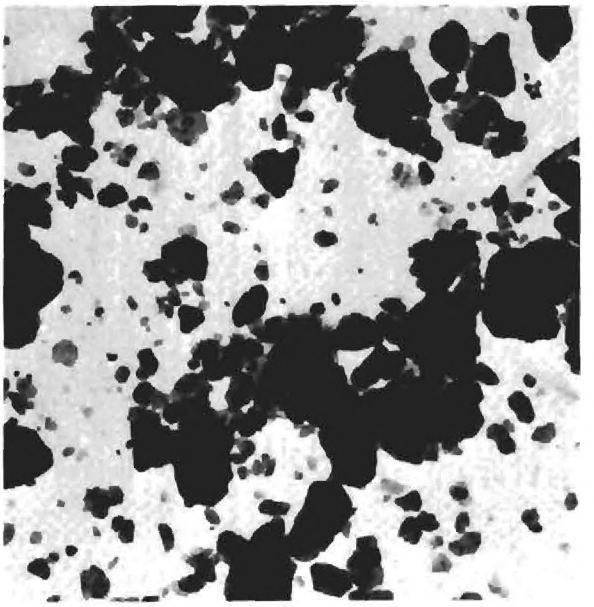
TEM 8300X

SAMPLE 00064

| SAMPLE 63 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 23' 47" | $K_2O$ | 0.64 | % |
| Longitude: | 82° 24' 43" | CaO | 0.06 | |
| Northing: | 3695960 | MgO | 0.27 | |
| Easting: | 368680 | $Al_2O_3$ | 35.54 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.01 | |
| 1/24,000 Quadrangle: | Dearing | $TiO_2$ | 0.83 | |
| County: | McDuffie | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 485' | $Fe_2O_3$ | 0.51 | |
| Overburden Thickness: | 16' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 20' | F | 0.0025 | |

| SAMPLE 64 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 15' 20" | $K_2O$ | 0.16 | % |
| Longitude: | 82° 29' 55" | CaO | 0.04 | |
| Northing: | 3680430 | MgO | 0.23 | |
| Easting: | 360400 | $Al_2O_3$ | 35.09 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.88 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.02 | |
| County: | Glascock | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 508' | $Fe_2O_3$ | 0.56 | |
| Overburden Thickness: | 111' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 34' | F | 0.0026 | |

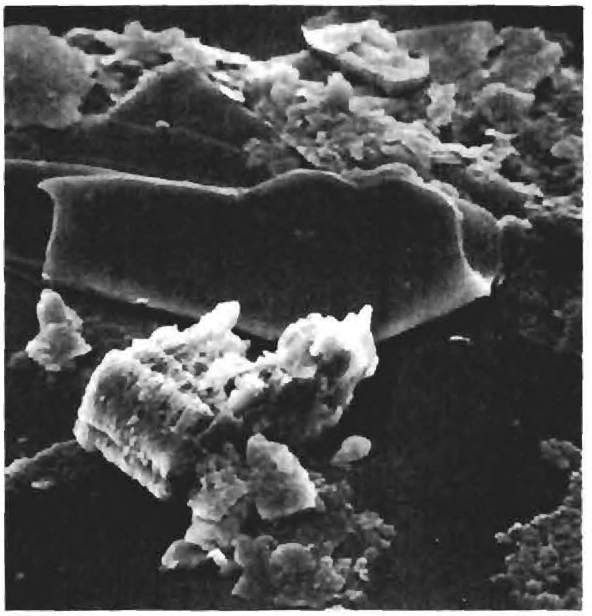




SEM 2000X

TEM 8300X

SAMPLE 00065



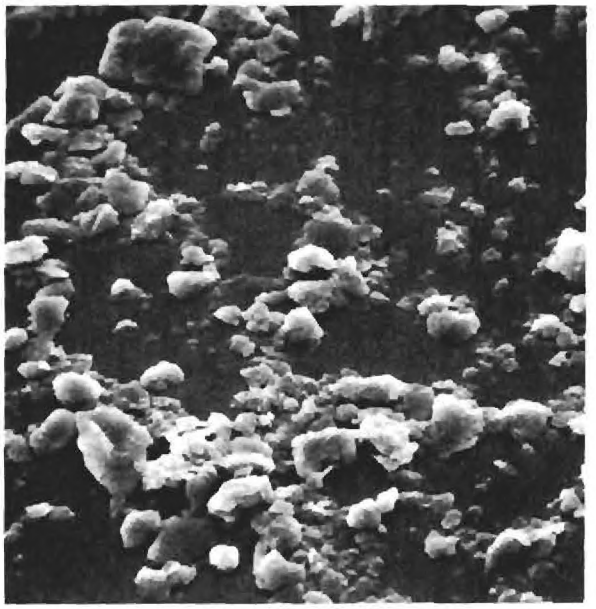
SEM 2000X

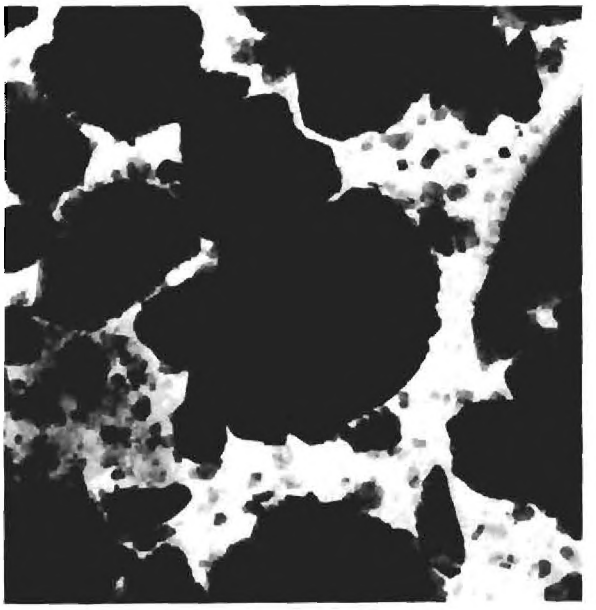
TEM 8300X

SAMPLE 00066

| SAMPLE 65 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 12' 25" | $K_2O$ | 0.75 | % |
| Longitude: | 82° 33' 18" | CaO | 0.27 | |
| Northing: | 3675110 | MgO | 0.58 | |
| Easting: | 354900 | $Al_2O_3$ | 35.39 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.84 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.93 | |
| County: | Glascock | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 360' | $Fe_2O_3$ | 0.43 | |
| Overburden Thickness: | 58' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0033 | |

| SAMPLE 66 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 14' 20" | $K_2O$ | 0.07 | % |
| Longitude: | 82° 31' 31" | CaO | 0.17 | |
| Northing: | 3678620 | MgO | 0.18 | |
| Easting: | 357900 | $Al_2O_3$ | 33.27 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 50.10 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.20 | |
| County: | Glascock | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 475' | $Fe_2O_3$ | 0.47 | |
| Overburden Thickness: | 148' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 20' | F | 0.0033 | |

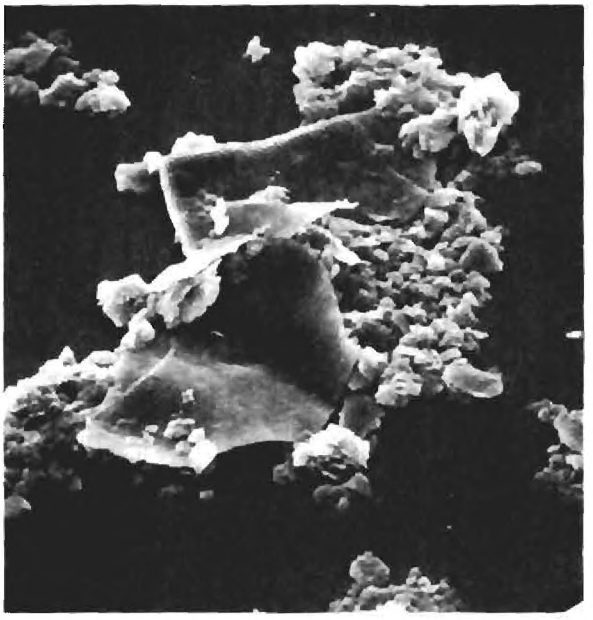


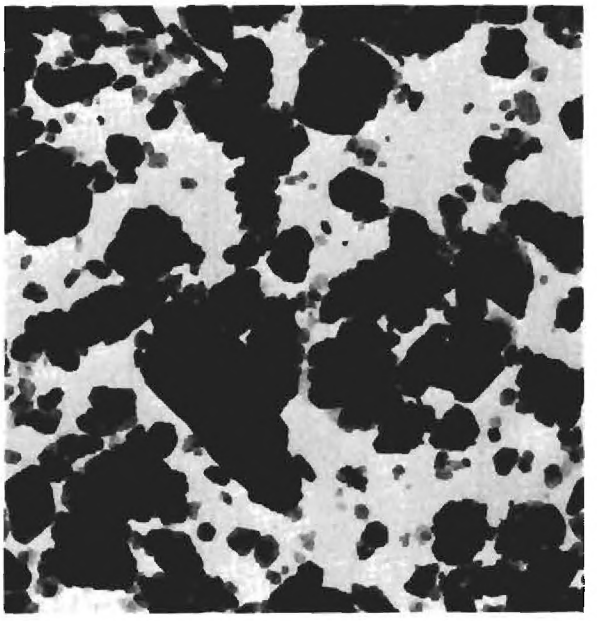


SEM 2000X

TEM 8300X

SAMPLE 00067





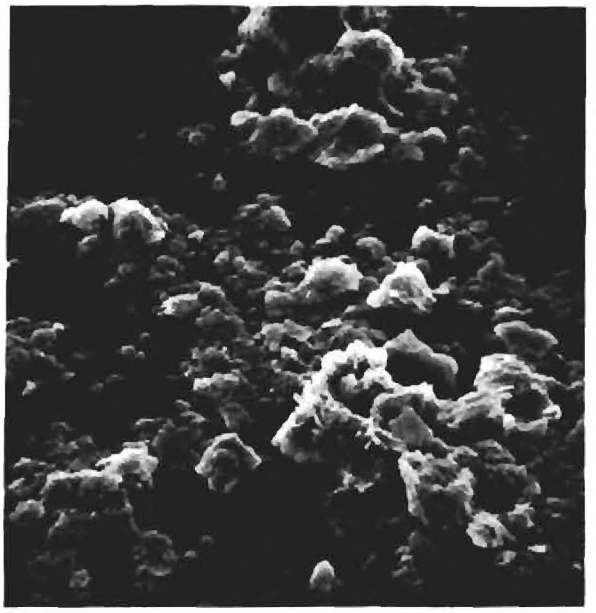
SEM 2000X

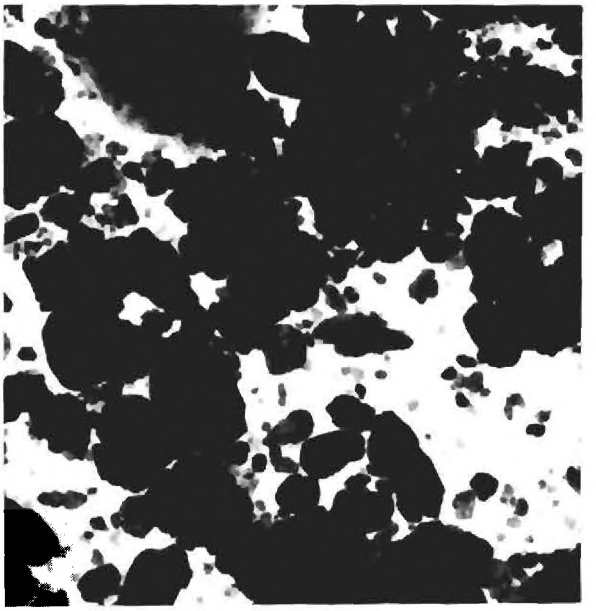
TEM 8300X

SAMPLE 00068

| SAMPLE 67 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 24" | $K_2O$ | 0.87 | % |
| Longitude: | 82° 40' 09" | CaO | 0.28 | |
| Northing: | 3671880 | MgO | 0.83 | |
| Easting: | 344370 | $Al_2O_3$ | 34.18 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.99 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.08 | |
| County: | Glascock | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 415' | $Fe_2O_3$ | 1.19 | |
| Overburden Thickness: | 63' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 24' | F | 0.0028 | |

| SAMPLE 68 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 06' 13" | $K_2O$ | 0.33 | % |
| Longitude: | 82° 34' 46" | CaO | 0.24 | |
| Northing: | 3663690 | MgO | 0.65 | |
| Easting: | 352630 | $Al_2O_3$ | 36.43 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.43 | |
| 1/24,000 Quadrangle: | Grange | $TiO_2$ | 1.67 | |
| County: | Jefferson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 360' | $Fe_2O_3$ | 1.19 | |
| Overburden Thickness: | 91' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 28' | F | 0.0026 | |

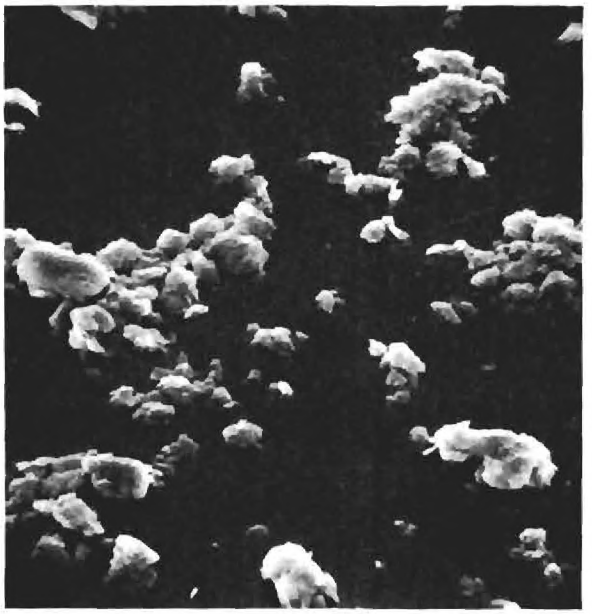


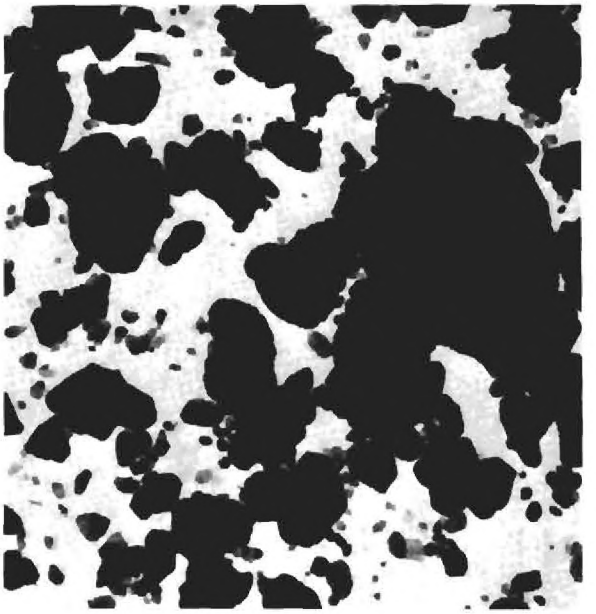


SEM 2000X

TEM 8300X

SAMPLE 00069





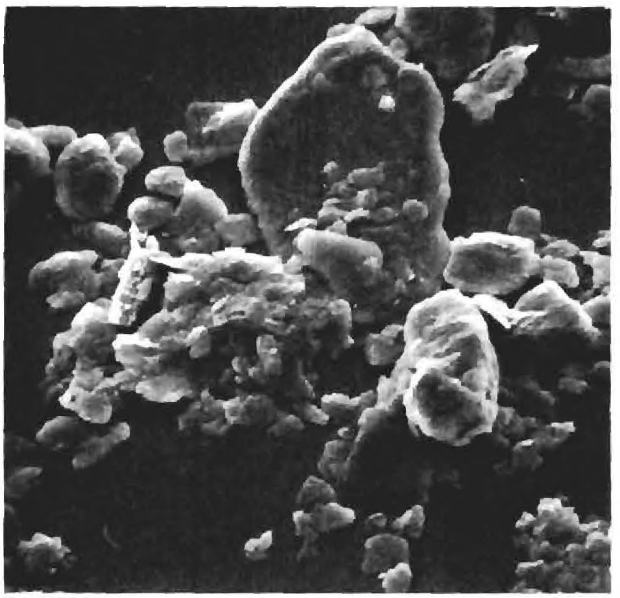
SEM 2000X

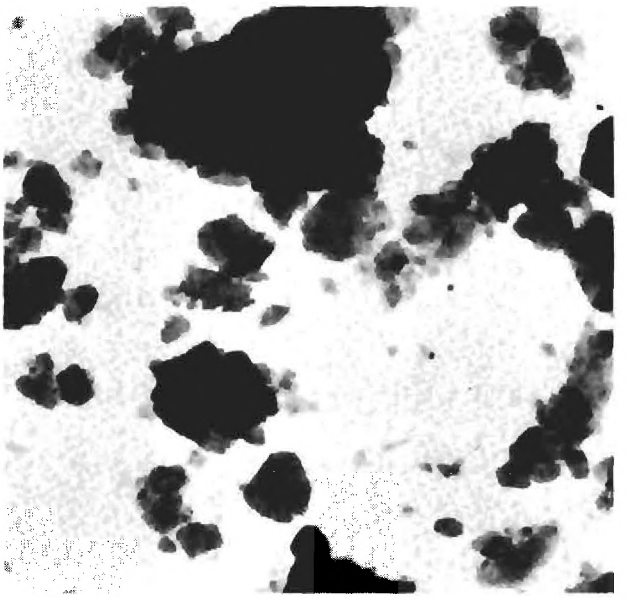
TEM 8300X

SAMPLE 00070

| SAMPLE 69 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 05' 51" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 36' 07" | CaO | 0.10 | |
| Northing: | 3663050 | MgO | 0.25 | |
| Easting: | 350490 | $Al_2O_3$ | 37.96 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.55 | |
| 1/24,000 Quadrangle: | Grange | $TiO_2$ | 0.88 | |
| County: | Jefferson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 442' | $Fe_2O_3$ | 0.61 | |
| Overburden Thickness: | 207' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 33' | F | 0.0048 | |

| SAMPLE 70 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 08' 19" | $K_2O$ | 0.54 | % |
| Longitude: | 82° 39' 21" | CaO | 0.15 | |
| Northing: | 3667700 | MgO | 0.99 | |
| Easting: | 345540 | $Al_2O_3$ | 34.97 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.56 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 2.65 | |
| County: | Glascock | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 419' | $Fe_2O_3$ | 1.49 | |
| Overburden Thickness: | 100' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 36' | F | 0.0023 | |

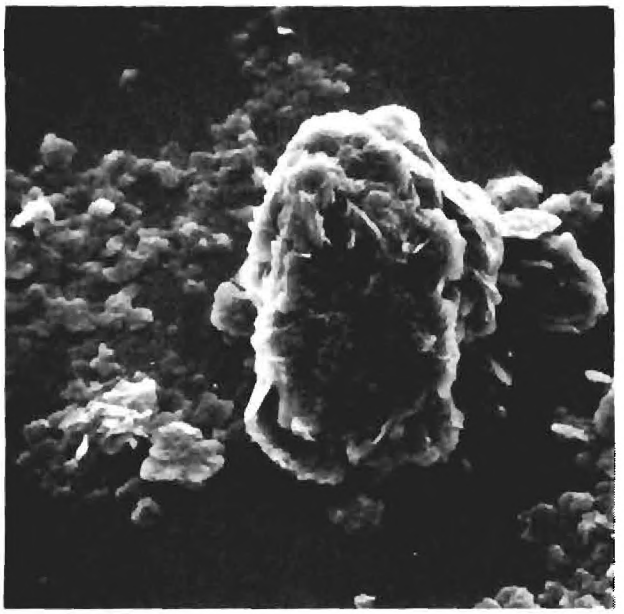


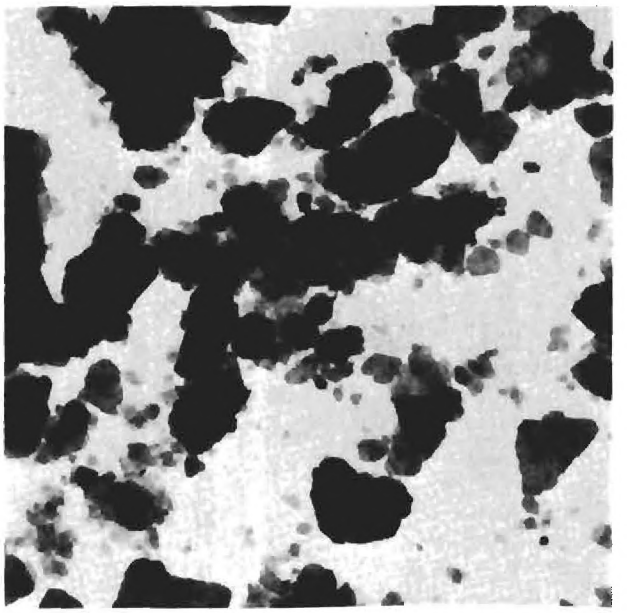


SEM 2000X

TEM 8300X

SAMPLE 00071





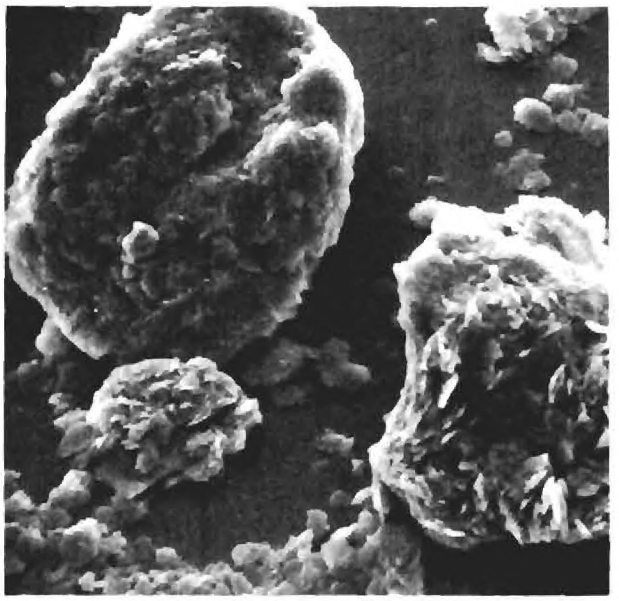
SEM 2000X

TEM 8300X

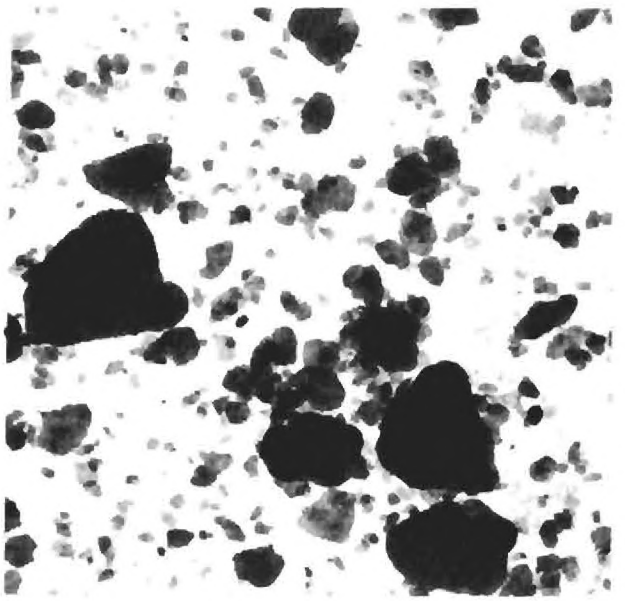
SAMPLE 00072

| SAMPLE 71 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: 33° 08' 26" | | $K_2O$ | 0.48 | % |
| Longitude: 82° 38' 33" | | CaO | 0.31 | |
| Northing: 3667880 | | MgO | 0.66 | |
| Easting: 346780 | | $Al_2O_3$ | 34.05 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.81 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 0.92 | |
| County: Glascock | | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 415' | $Fe_2O_3$ | 0.86 | |
| Overburden Thickness: | 113' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 37' | F | 0.0026 | |

| SAMPLE 72 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: 33° 08' 38" | | $K_2O$ | 0.53 | % |
| Longitude: 82° 39' 58" | | CaO | 0.29 | |
| Northing: 3668310 | | MgO | 0.86 | |
| Easting: 344590 | | $Al_2O_3$ | 35.84 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 45.85 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.27 | |
| County: Glascock | | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 366' | $Fe_2O_3$ | 1.44 | |
| Overburden Thickness: | 61' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 34' | F | 0.0038 | |

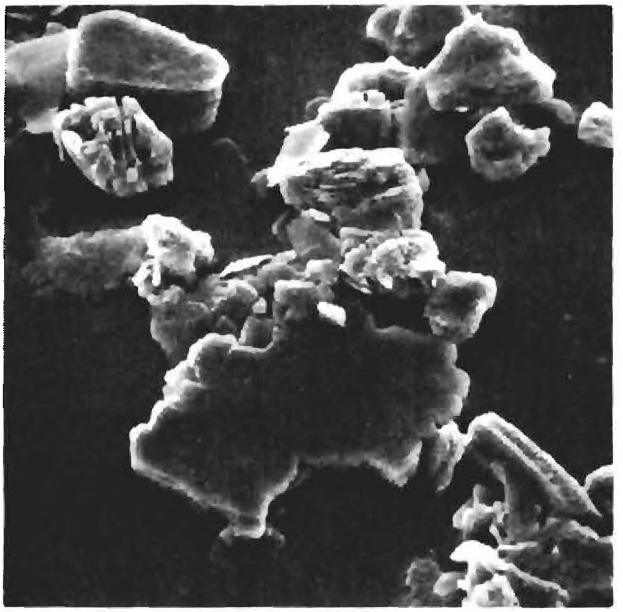


SEM 2000X

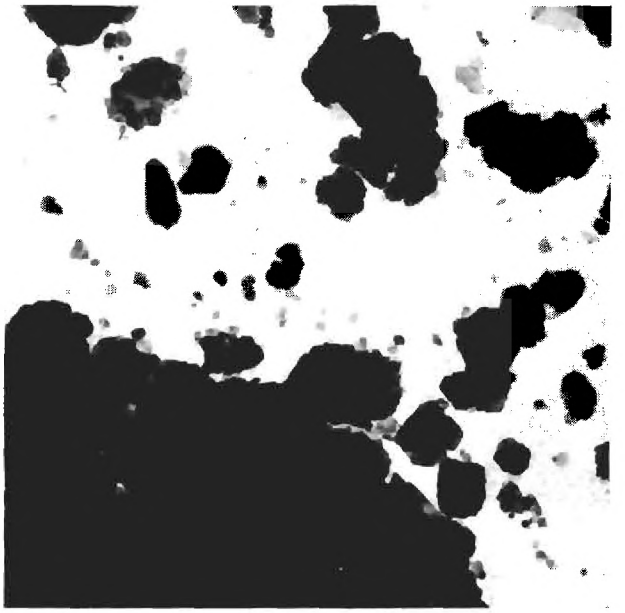


TEM 8300X

SAMPLE 00073



SEM 2000X

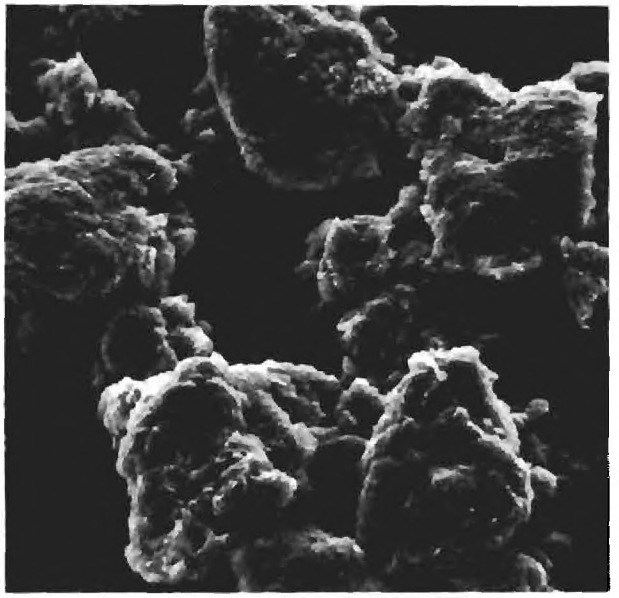


TEM 8300X

SAMPLE 00074

| SAMPLE 73 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 08' 39" | $K_2O$ | 0.69 | % |
| Longitude: | 82° 38' 44" | CaO | 0.34 | |
| Northing: | 3668280 | MgO | 0.28 | |
| Easting: | 346530 | $Al_2O_3$ | 35.30 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.20 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 1.53 | |
| County: | Glascock | $Cr_2O_3$ | 0.12 | |
| Surface Elevation: | 440' | $Fe_2O_3$ | 0.73 | |
| Overburden Thickness: | 105' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 29' | F | 0.0024 | |

| SAMPLE 74 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 14' 57" | $K_2O$ | 0.41 | % |
| Longitude: | 82° 33' 07" | CaO | 0.20 | |
| Northing: | 3679800 | MgO | 0.55 | |
| Easting: | 355430 | $Al_2O_3$ | 36.18 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.11 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 1.25 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 391' | $Fe_2O_3$ | 1.06 | |
| Overburden Thickness: | 52' | $P_2O_5$ | 0.009165 | |
| Ore Thickness: | 13' | F | 0.0031 | |



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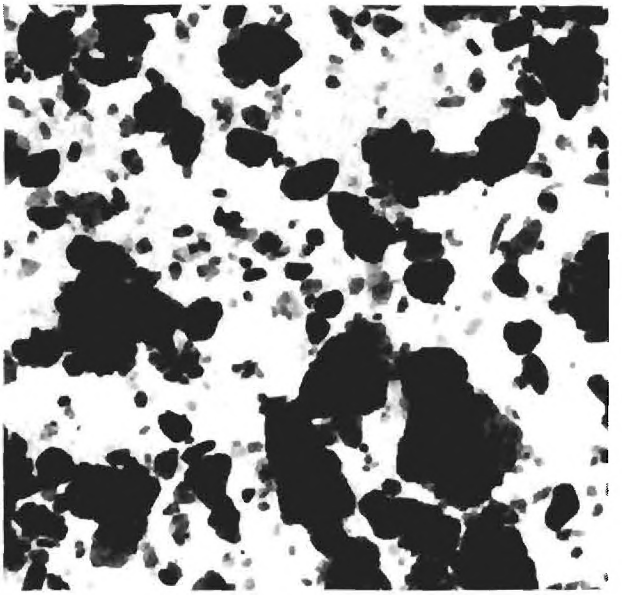
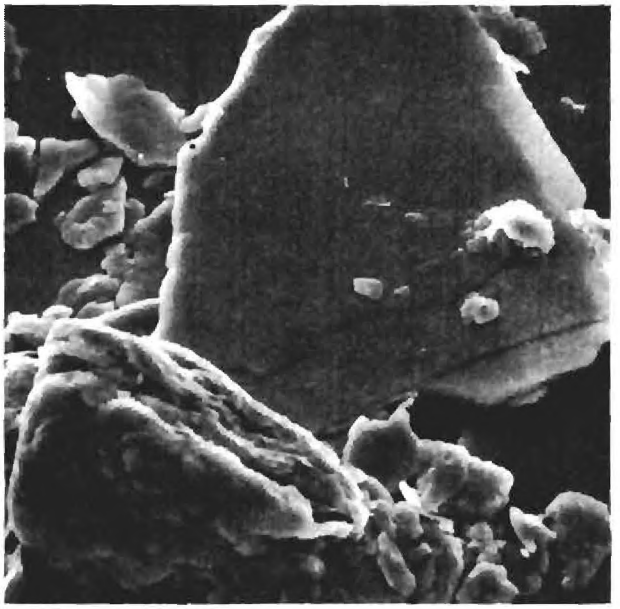
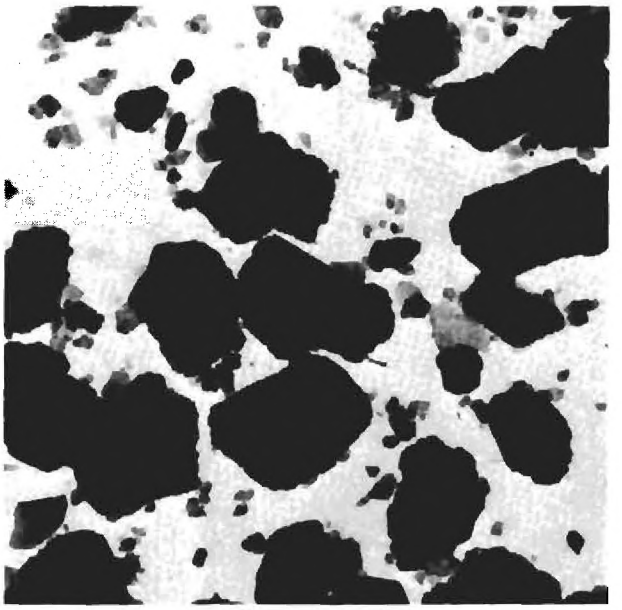


TEM 8300X

SAMPLE 00075



SEM 2000X

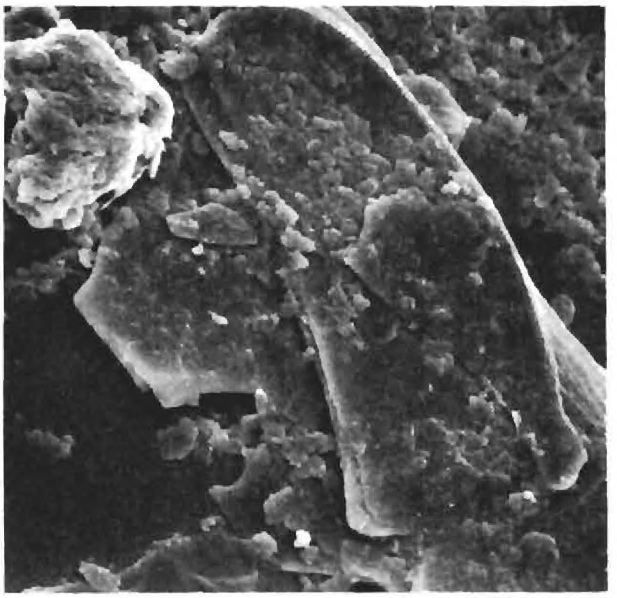


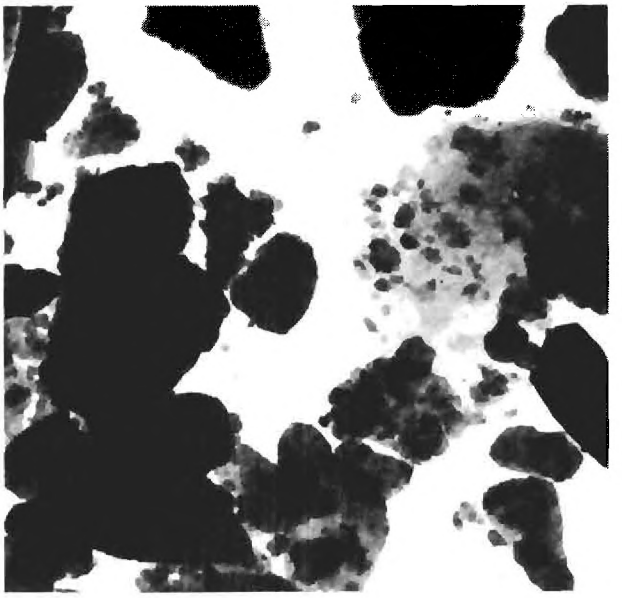
TEM 8300X

SAMPLE 00076

| SAMPLE 75 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 09' 08" | $K_2O$ | 0.29 | % |
| Longitude: | 82° 36' 04" | CaO | 3.02 | |
| Northing: | 3669100 | MgO | 0.73 | |
| Easting: | 350660 | $Al_2O_3$ | 35.13 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.98 | |
| 1/24,000 Quadrangle: | Gibson | $TiO_2$ | 0.97 | |
| County: | Glascock | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 401' | $Fe_2O_3$ | 0.94 | |
| Overburden Thickness: | 94' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 20' | F | 0.0026 | |

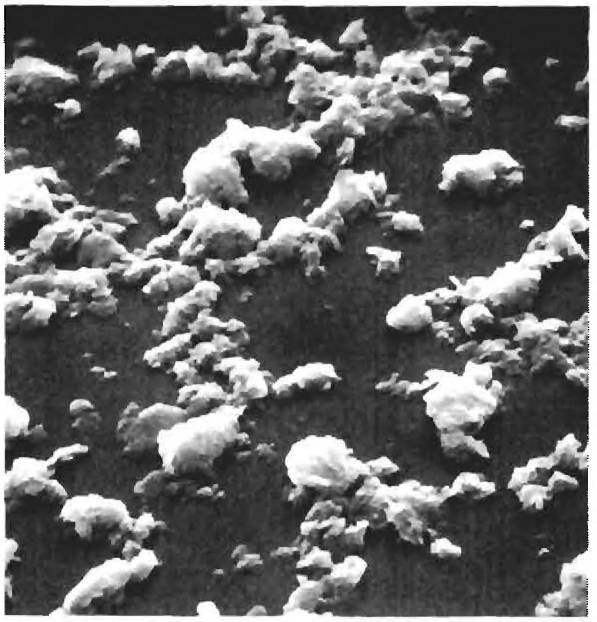
| SAMPLE 76 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 10' 56" | $K_2O$ | 0.49 | % |
| Longitude: | 82° 39' 19" | CaO | 0.31 | |
| Northing: | 3672510 | MgO | 0.83 | |
| Easting: | 345680 | $Al_2O_3$ | 34.07 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.95 | |
| 1/24,000 Quadrangle: | Mitchell | $TiO_2$ | 0.88 | |
| County: | Glascock | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 416' | $Fe_2O_3$ | 1.29 | |
| Overburden Thickness: | 14' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 32' | F | 0.0029 | |

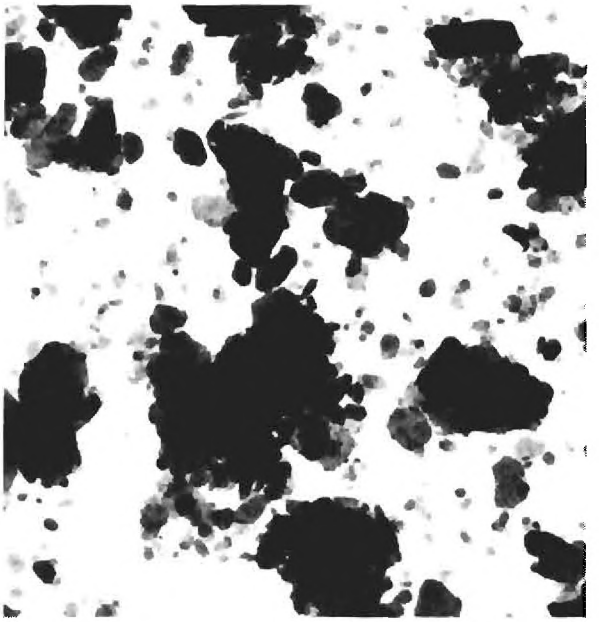




SEM 2000X TEM 8300X

SAMPLE 00077



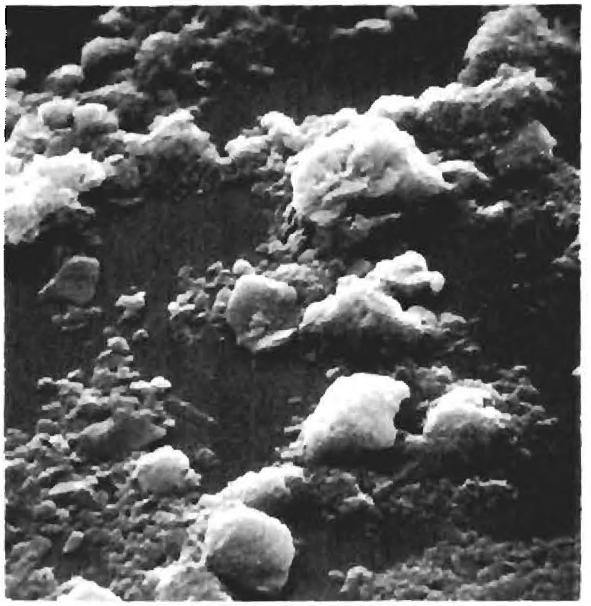


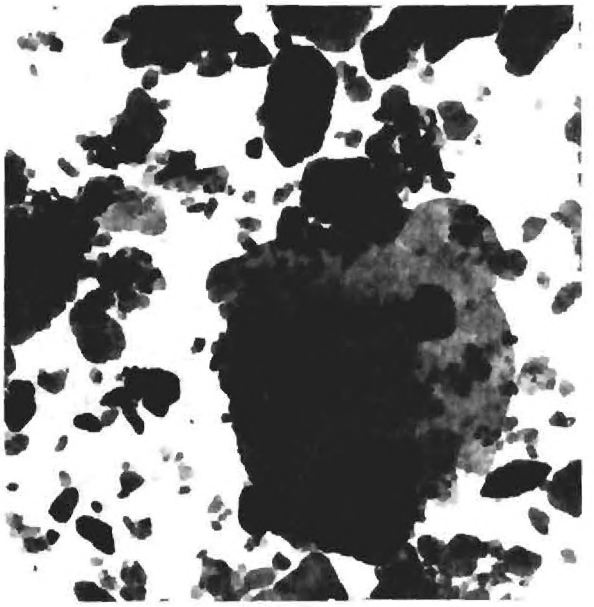
SEM 2000X TEM 8300X

SAMPLE 10078

| SAMPLE 77 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 21' 01" | $K_2O$ | 0.70 | % |
| Longitude: | 82° 25' 54" | CaO | 0.22 | |
| Northing: | 3690850 | MgO | 0.91 | |
| Easting: | 366790 | $Al_2O_3$ | 35.13 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.35 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.43 | |
| County: | McDuffie | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 469' | $Fe_2O_3$ | 1.20 | |
| Overburden Thickness: | 63' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 22' | F | 0.0037 | |

| SAMPLE 78 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 18' 58" | $K_2O$ | 0.25 | % |
| Longitude: | 82° 26' 04" | CaO | 0.43 | |
| Northing: | 3687080 | MgO | 0.76 | |
| Easting: | 366480 | $Al_2O_3$ | 35.16 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.13 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.48 | |
| County: | Warren | $Cr_2O_3$ | 1.18 | |
| Surface Elevation: | 435' | $Fe_2O_3$ | 1.16 | |
| Overburden Thickness: | 30' | $P_2O_5$ | NA | |
| Ore Thickness: | 25' | F | NA | |

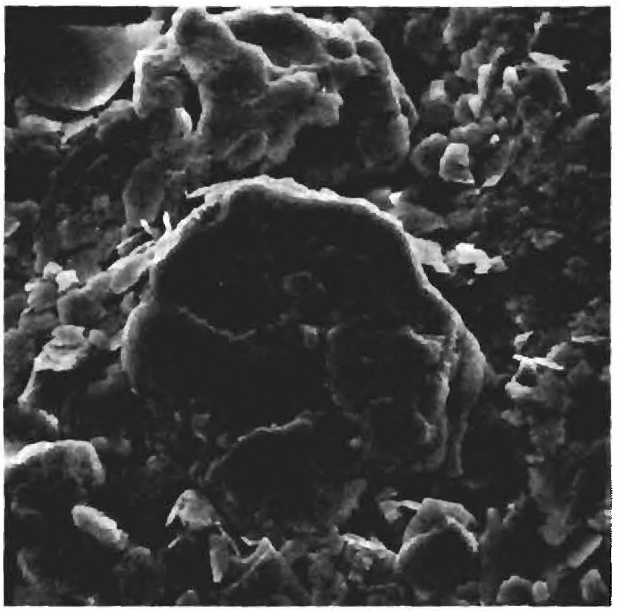


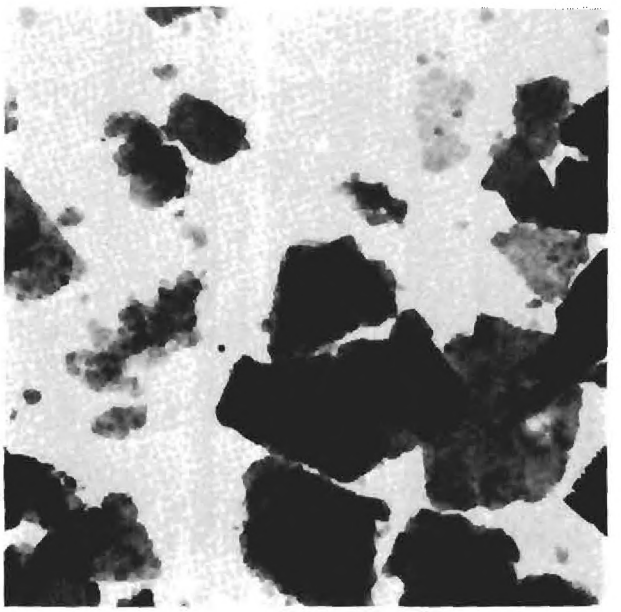


SEM 2000X

TEM 8300X

SAMPLE 10079





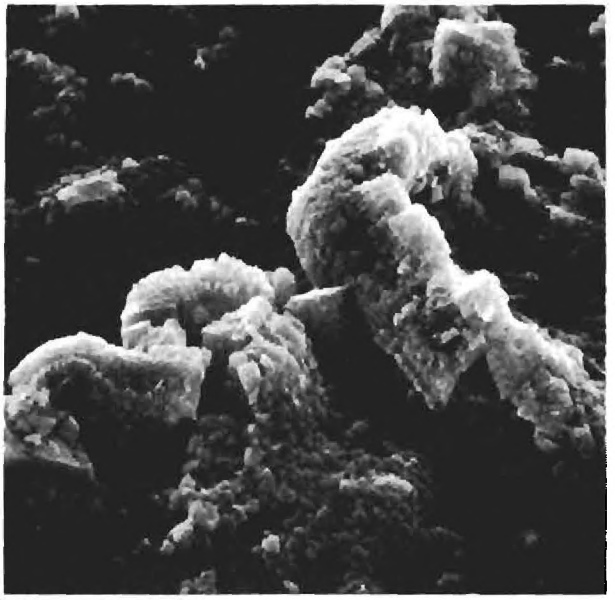
SEM 2000X

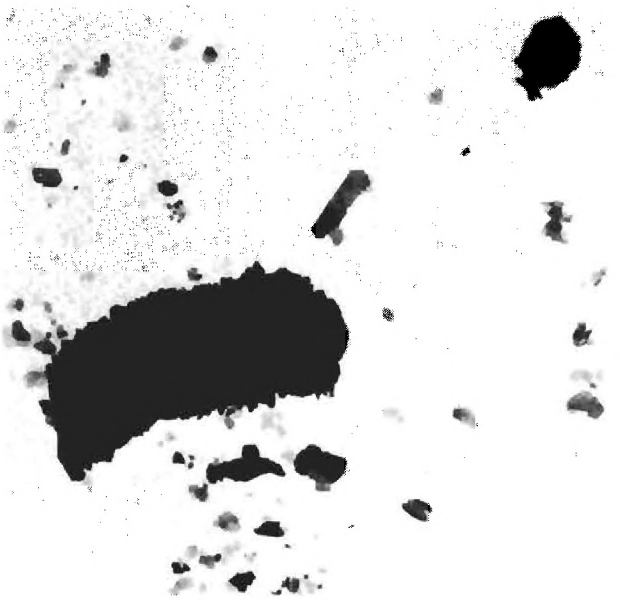
TEM 8300X

SAMPLE 00080

| SAMPLE 79 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 19' 18" | $K_2O$ | 0.11 | % |
| Longitude: | 82° 27' 01" | CaO | 0.57 | |
| Northing: | 3687710 | MgO | 0.85 | |
| Easting: | 365040 | $Al_2O_3$ | 37.79 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 46.15 | |
| 1/24,000 Quadrangle: | Bowdens Pond | $TiO_2$ | 1.35 | |
| County: | Warren | $Cr_2O_3$ | 0.60 | |
| Surface Elevation: | 490' | $Fe_2O_3$ | 0.59 | |
| Overburden Thickness: | 70' | $P_2O_5$ | NA | |
| Ore Thickness: | 30' | F | NA | |

| SAMPLE 80 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 51' 23" | $K_2O$ | 0.06 | % |
| Longitude: | 83° 11' 01" | CaO | 0.08 | |
| Northing: | 3637300 | MgO | 0.46 | |
| Easting: | 295670 | $Al_2O_3$ | 32.80 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 53.29 | |
| 1/24,000 Quadrangle: | Irwinton | $TiO_2$ | 1.17 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 1.10 | |
| Overburden Thickness: | 28' | $P_2O_5$ | NA | |
| Ore Thickness: | 20' | F | NA | |

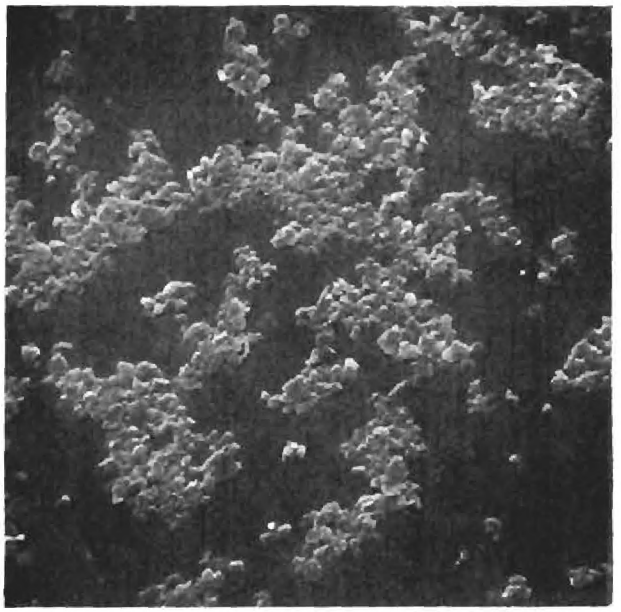


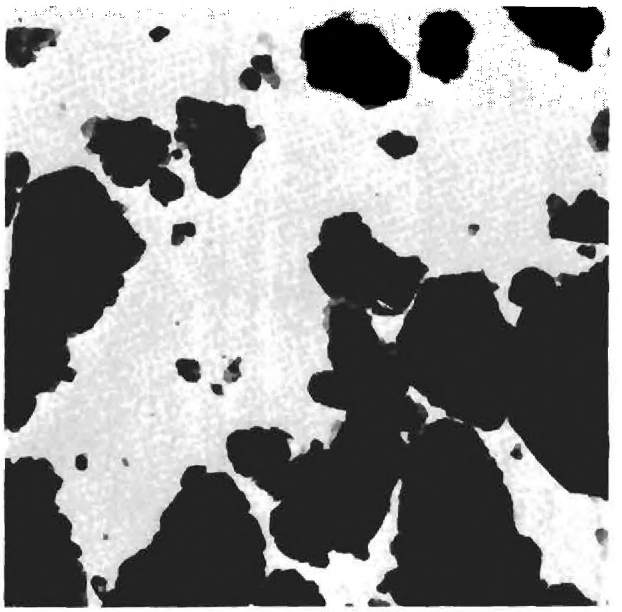


SEM 2000X

TEM 8300X

SAMPLE 00081





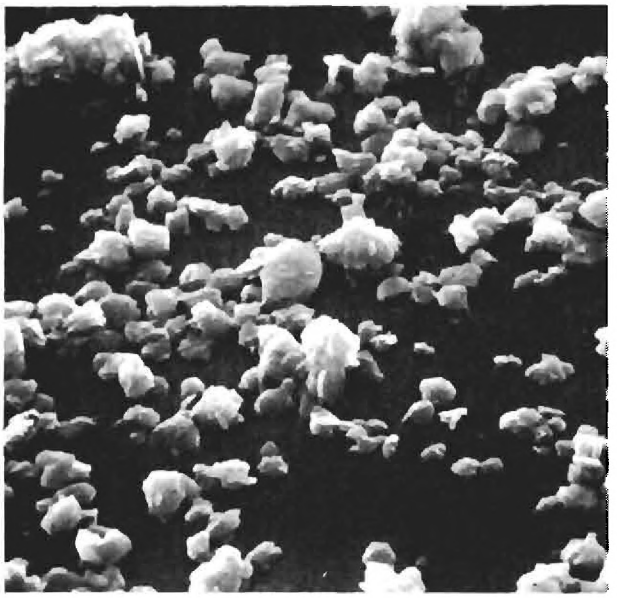
SEM 2000X

TEM 8300X

SAMPLE 00082

| SAMPLE 81 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 47' 40" | $K_2O$ | 0.27 | % |
| Longitude: | 83° 17' 00" | CaO | 0.11 | |
| Northing: | 3630600 | MgO | 0.73 | |
| Easting: | 286120 | $Al_2O_3$ | 35.58 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 47.86 | |
| 1/24,000 Quadrangle: | Massey Hill | $TiO_2$ | 1.18 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 0.49 | |
| Overburden Thickness: | 13' | $P_2O_5$ | NA | |
| Ore Thickness: | 25' | F | NA | |

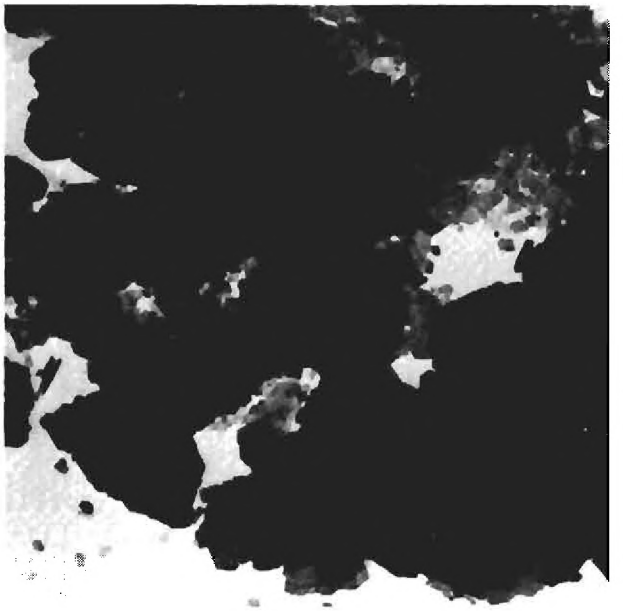
| SAMPLE 82 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 48' 20" | $K_2O$ | 0.22 | % |
| Longitude: | 83° 12' 15" | CaO | 0.04 | |
| Northing: | 3631700 | MgO | 0.51 | |
| Easting: | 293600 | $Al_2O_3$ | 36.11 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.35 | |
| 1/24,000 Quadrangle: | Irwinton | $TiO_2$ | 0.93 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | --- | $Fe_2O_3$ | 1.06 | |
| Overburden Thickness: | --- | $P_2O_5$ | NA | |
| Ore Thickness: | 15' | F | NA | |



SEM 2000X

TEM 8300X

SAMPLE 00083



SEM 2000X

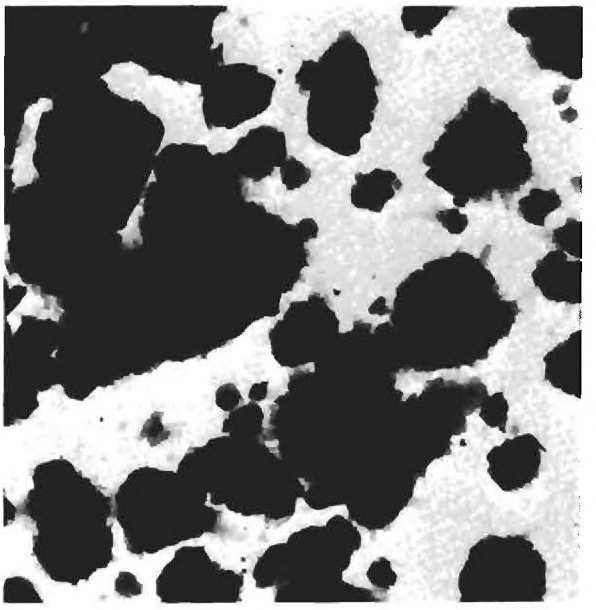
TEM 8300X

SAMPLE 00084

| SAMPLE 83 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 51' 05" | $K_2O$ | 0.34 | % |
| Longitude: | 83° 24' 10" | CaO | 0.57 | |
| Northing: | 3637200 | MgO | 1.56 | |
| Easting: | 275250 | $Al_2O_3$ | 35.73 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 51.07 | |
| 1/24,000 Quadrangle: | Dry Branch | $TiO_2$ | 1.40 | |
| County: | Twiggs | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 470' | $Fe_2O_3$ | 0.77 | |
| Overburden Thickness: | 34' | $P_2O_5$ | NA | |
| Ore Thickness: | 25' | F | NA | |

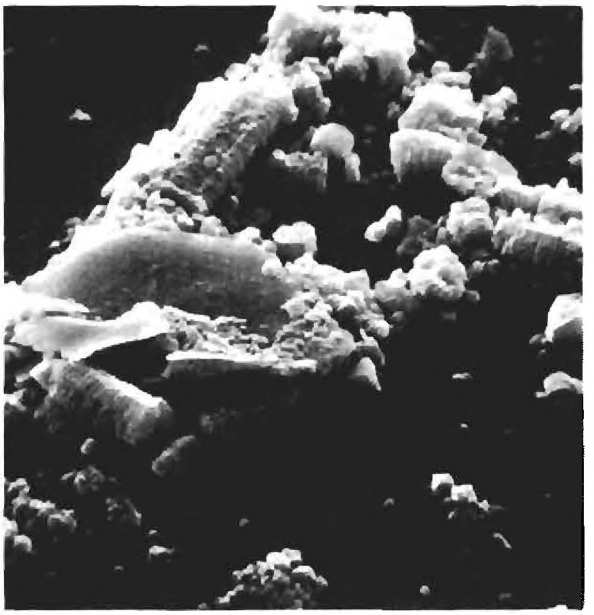
| SAMPLE 84 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 49' 30" | $K_2O$ | 0.53 | % |
| Longitude: | 83° 24' 40" | CaO | 0.34 | |
| Northing: | 3634250 | MgO | 1.19 | |
| Easting: | 274350 | $Al_2O_3$ | 35.90 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 46.17 | |
| 1/24,000 Quadrangle: | Dry Branch | $TiO_2$ | 1.35 | |
| County: | Twiggs | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 420' | $Fe_2O_3$ | 0.81 | |
| Overburden Thickness: | 18' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 25' | F | 0.0211 | |

SEM 2000X



TEM 8300X

SAMPLE 00085



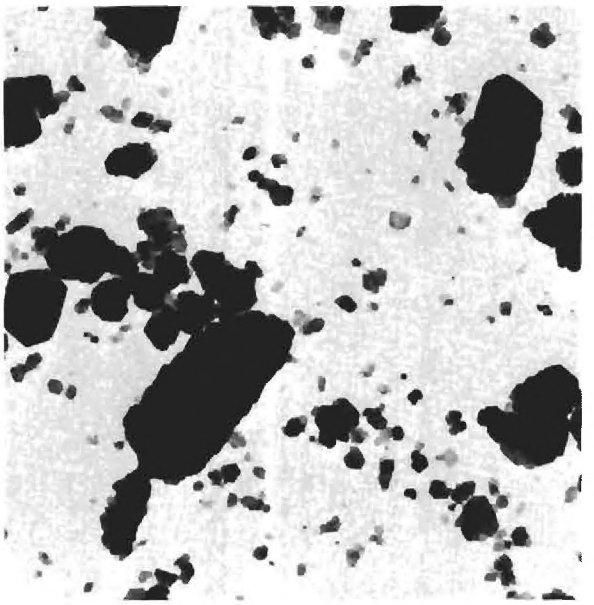
SEM 2000X

TEM 8300X

SAMPLE 00086

| SAMPLE 85 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 48' 25" | $K_2O$ | 0.10 | % |
| Longitude: | 83° 23' 20" | CaO | 0.04 | |
| Northing: | 3632250 | MgO | 0.50 | |
| Easting: | 276300 | $Al_2O_3$ | 35.48 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.27 | |
| 1/24,000 Quadrangle: | Dry Branch | $TiO_2$ | 0.97 | |
| County: | Twiggs | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 350' | $Fe_2O_3$ | 0.41 | |
| Overburden Thickness: | 19' | $P_2O_5$ | 0.004583 | |
| Ore Thickness: | 25' | F | 0.0266 | |

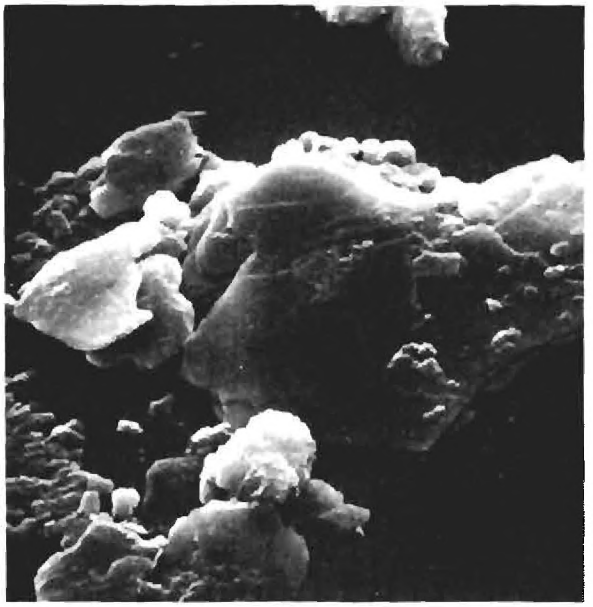
| SAMPLE 86 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 47' 00" | $K_2O$ | 0.20 | % |
| Longitude: | 83° 23' 15" | CaO | 0.32 | |
| Northing: | 3629600 | MgO | 1.36 | |
| Easting: | 276450 | $Al_2O_3$ | 33.99 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.78 | |
| 1/24,000 Quadrangle: | Dry Branch | $TiO_2$ | 1.18 | |
| County: | Twiggs | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 340' | $Fe_2O_3$ | 0.77 | |
| Overburden Thickness: | 33' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0184 | |

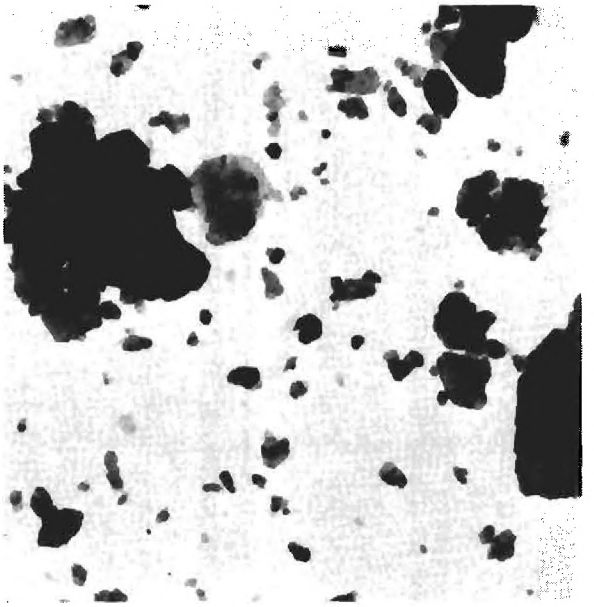


SEM 2000X

TEM 8300X

SAMPLE 00087





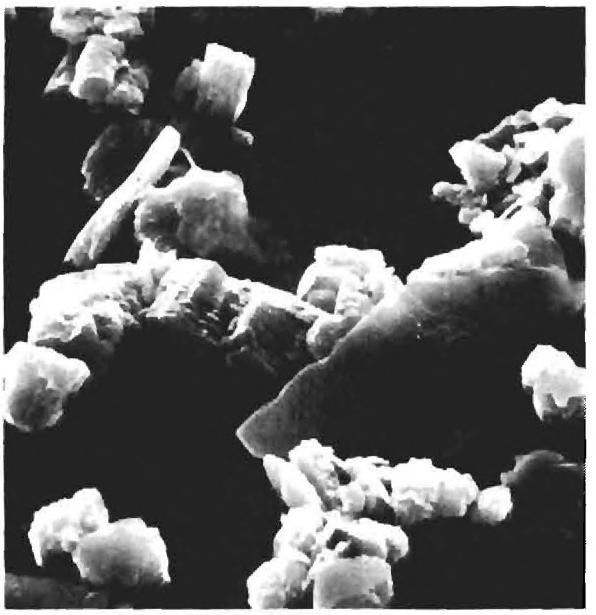
SEM 2000X

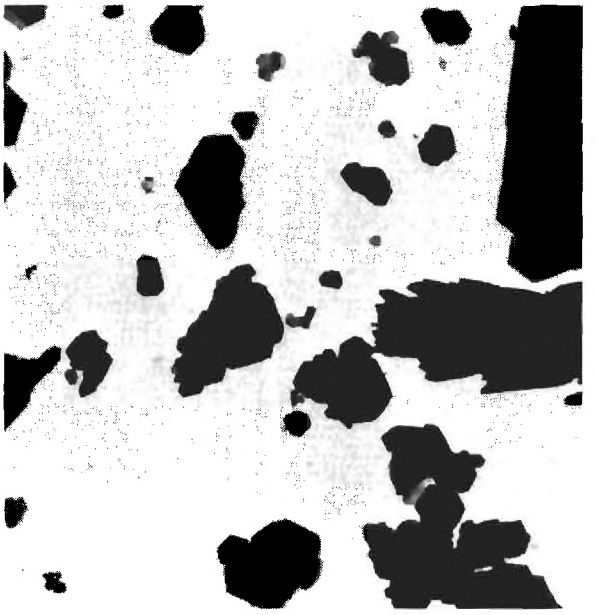
TEM 8300X

SAMPLE 00088

| SAMPLE 87 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 51' 10" | $K_2O$ | 0.19 | % |
| Longitude: | 83° 20' 15" | CaO | 0.07 | |
| Northing: | 3637200 | MgO | 0.25 | |
| Easting: | 281270 | $Al_2O_3$ | 35.16 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.29 | |
| 1/24,000 Quadrangle: | Massey Hill | $TiO_2$ | 0.92 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.12 | |
| Surface Elevation: | 406' | $Fe_2O_3$ | 1.07 | |
| Overburden Thickness: | 30' | $P_2O_5$ | 0.006874 | |
| Ore Thickness: | 25' | F | 0.0129 | |

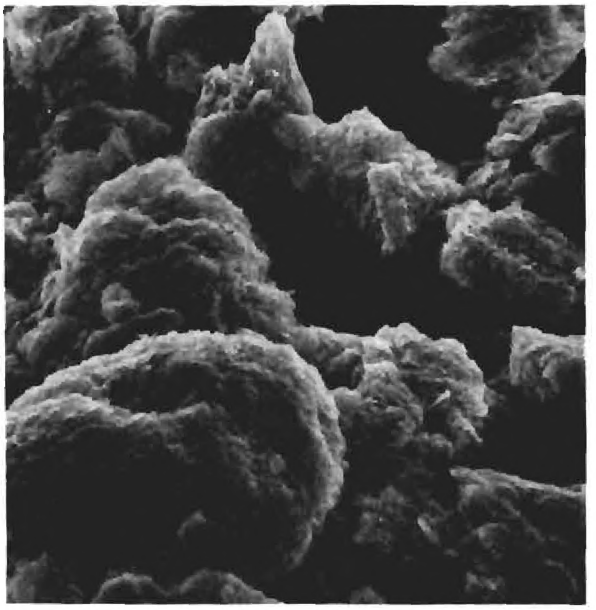
| SAMPLE 88 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 44' 30" | $K_2O$ | 0.67 | % |
| Longitude: | 83° 17' 05" | CaO | 0.10 | |
| Northing: | 3624700 | MgO | 0.20 | |
| Easting: | 285950 | $Al_2O_3$ | 35.14 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.10 | |
| 1/24,000 Quadrangle: | Jeffersonville | $TiO_2$ | 1.00 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 360' | $Fe_2O_3$ | 1.06 | |
| Overburden Thickness: | 46' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 30' | F | 0.0057 | |

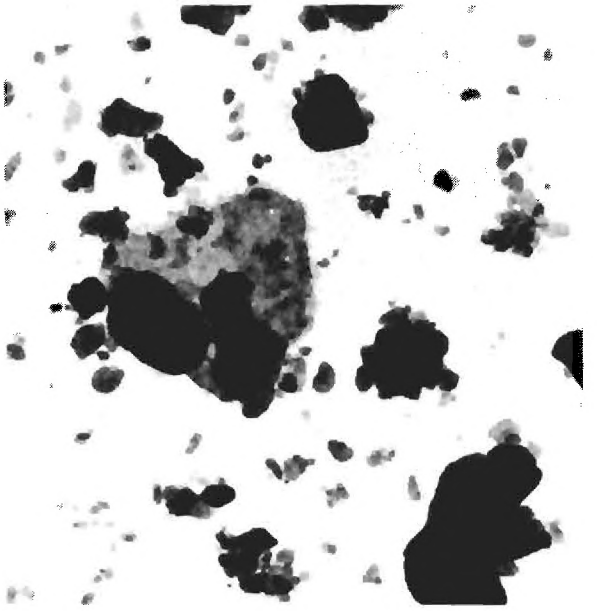




SEM 2000X TEM 8300X

SAMPLE 00089



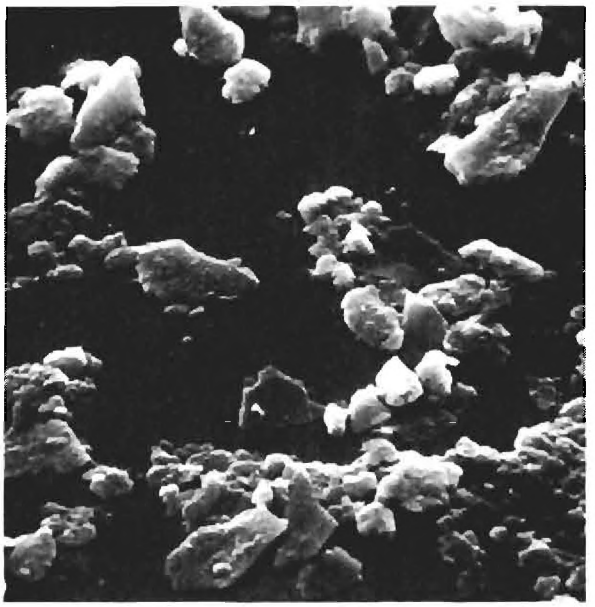


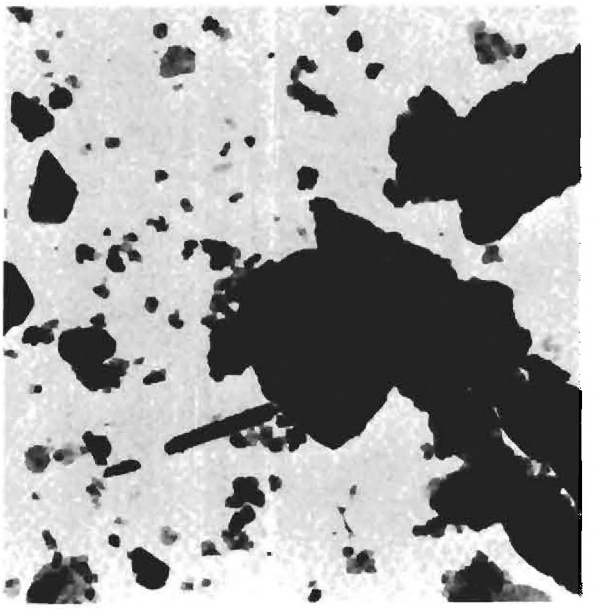
SEM 2000X TEM 8300X

SAMPLE 10090

| SAMPLE 89 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 00' 30" | $K_2O$ | 0.41 | % |
| Longitude: | 83° 02' 35" | CaO | 0.22 | |
| Northing: | 3653900 | MgO | 0.85 | |
| Easting: | 309150 | $Al_2O_3$ | 35.52 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 49.10 | |
| 1/24,000 Quadrangle: | Friendship | $TiO_2$ | 1.07 | |
| County: | Washington | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 360' | $Fe_2O_3$ | 0.54 | |
| Overburden Thickness: | 40' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 20' | F | 0.0054 | |

| SAMPLE 90-a | | Chemical Analyses of Selected Elements | |
|---|---|---|---|
| Latitude: | 32° 50' 20" | $K_2O$ | 0.18 |
| Longitude: | 83° 02' 20" | CaO | 0.17 |
| Northing: | 3635050 | MgO | 0.27 |
| Easting: | 309150 | $Al_2O_3$ | 36.58 |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 46.85 |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.35 |
| County: | Wilkinson | $Cr_2O_3$ | 0.01 |
| Surface Elevation: | 275' | $Fe_2O_3$ | 0.71 |
| Overburden Thickness: | 25' | $P_2O_5$ | 0.002291 |
| Ore Thickness: | 35' | F | 0.0282 |

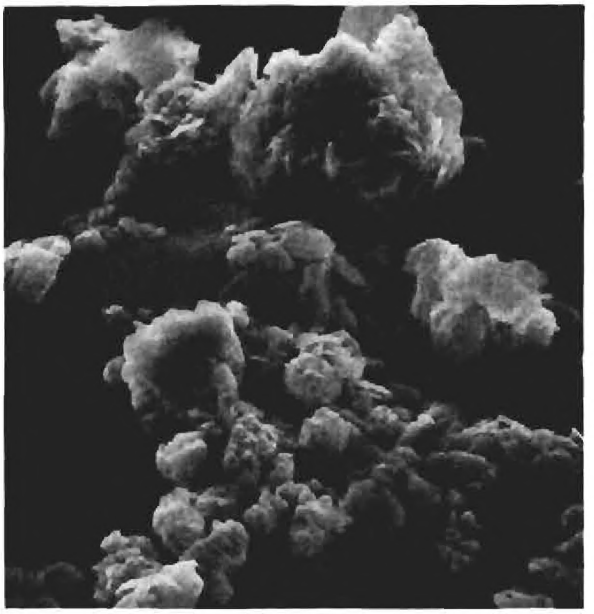


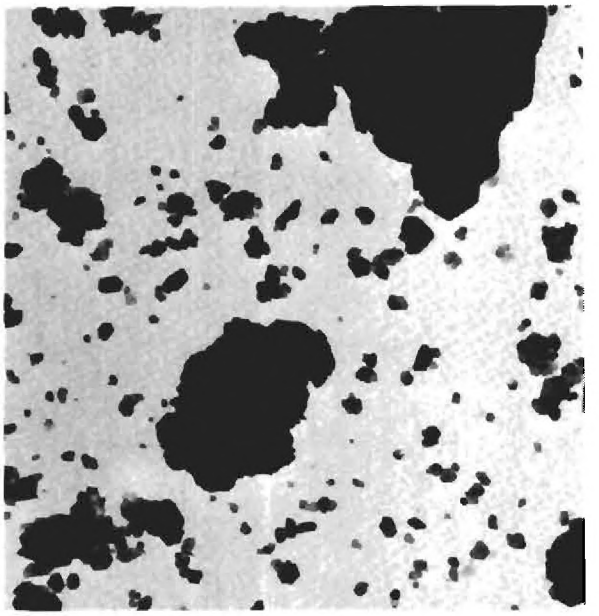


SEM 2000X

TEM 8300X

SAMPLE 20090





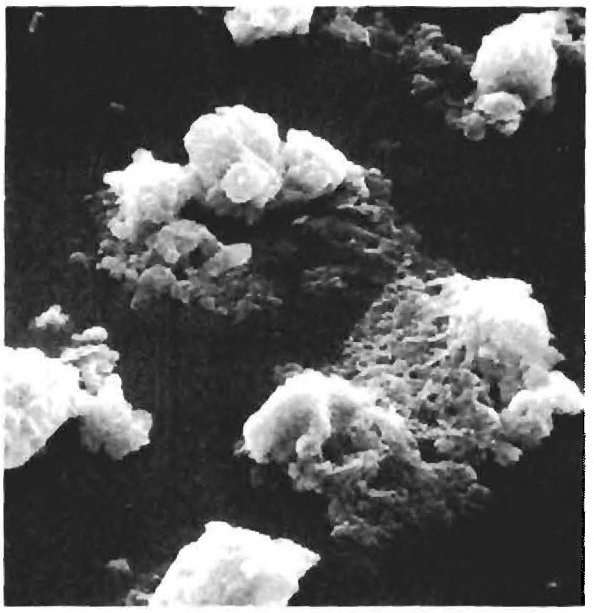
SEM 2000X

TEM 8300X

SAMPLE 00091

| SAMPLE 90-b | | Chemical Analyses of Selected Elements * | | |
|---|---|---|---|---|
| Latitude: 32° 50' 20" | | $K_2O$ | 0.18 | % |
| Longitude: 83° 02' 20" | | CaO | 0.17 | |
| Northing: 3635050 | | MgO | 0.26 | |
| Easting: 309150 | | $Al_2O_3$ | 36.58 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 46.85 | |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.35 | |
| County: Wilkinson | | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 285' | $Fe_2O_3$ | 0.71 | |
| Overburden Thickness: | 35' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0282 | |
| | | *Analysis of 90-a is a composite of total kaolin. | | |

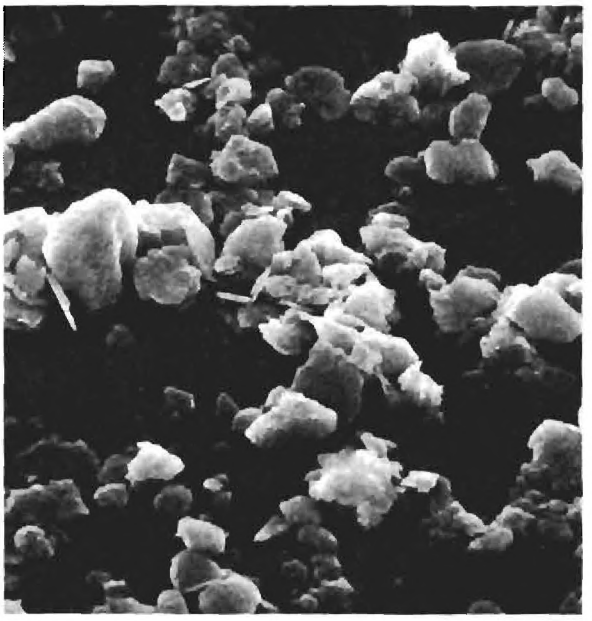
| SAMPLE 91 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: 32° 52' 55" | | $K_2O$ | 0.11 | % |
| Longitude: 83° 09' 30" | | CaO | 0.07 | |
| Northing: 3638230 | | MgO | 1.33 | |
| Easting: 298020 | | $Al_2O_3$ | 35.50 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.16 | |
| 1/24,000 Quadrangle: | Napier Pond | $TiO_2$ | 1.00 | |
| County: Wilkinson | | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 280' | $Fe_2O_3$ | 0.80 | |
| Overburden Thickness: | 15' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0021 | |

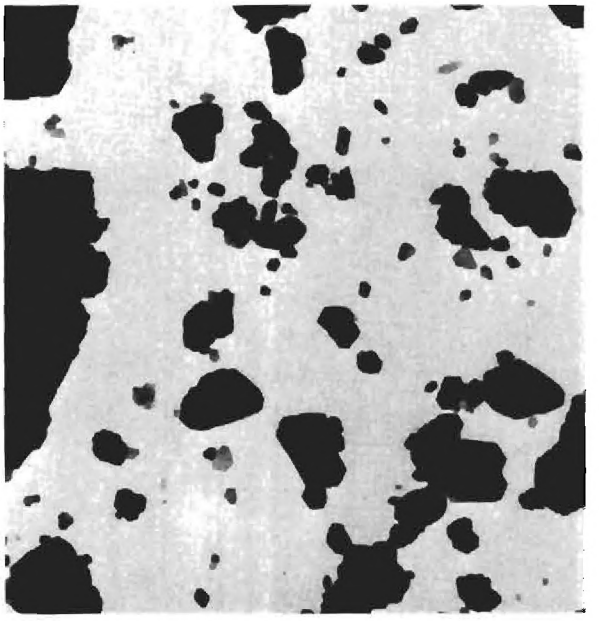


SEM 2000X

TEM 8300X

SAMPLE 00092





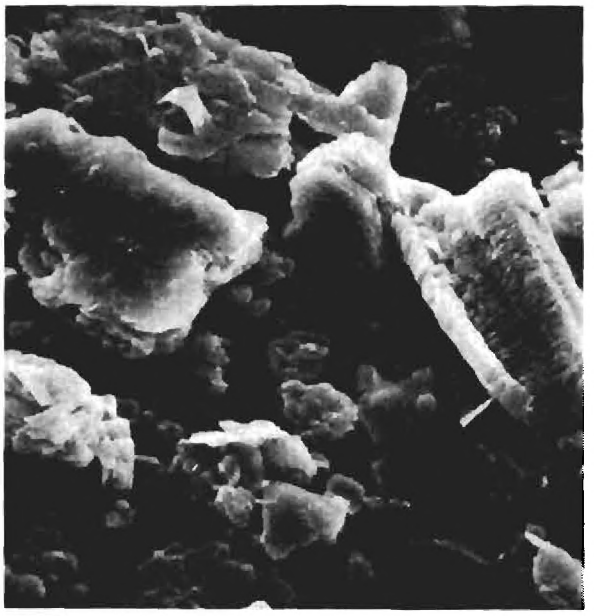
SEM 2000X

TEM 8300X

SAMPLE 00093

| SAMPLE 92 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 54' 40" | $K_2O$ | 0.22 | % |
| Longitude: | 83° 06' 15" | CaO | 0.08 | |
| Northing: | 3643200 | MgO | 0.45 | |
| Easting: | 303150 | $Al_2O_3$ | 34.56 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.82 | |
| 1/24,000 Quadrangle: | Gumm Pond | $TiO_2$ | 1.37 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 330' | $Fe_2O_3$ | 1.13 | |
| Overburden Thickness: | 60' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0023 | |

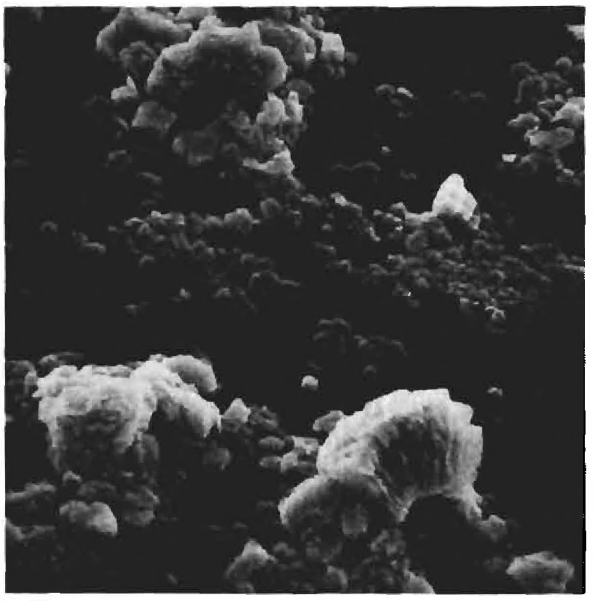
| SAMPLE 93 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 54' 10" | $K_2O$ | 0.13 | % |
| Longitude: | 83° 06' 00" | CaO | 0.06 | |
| Northing: | 3642250 | MgO | 0.80 | |
| Easting: | 303650 | $Al_2O_3$ | 33.86 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.99 | |
| 1/24,000 Quadrangle: | Gumm Pond | $TiO_2$ | 1.03 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | --- | $Fe_2O_3$ | 0.92 | |
| Overburden Thickness: | --- | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0020 | |

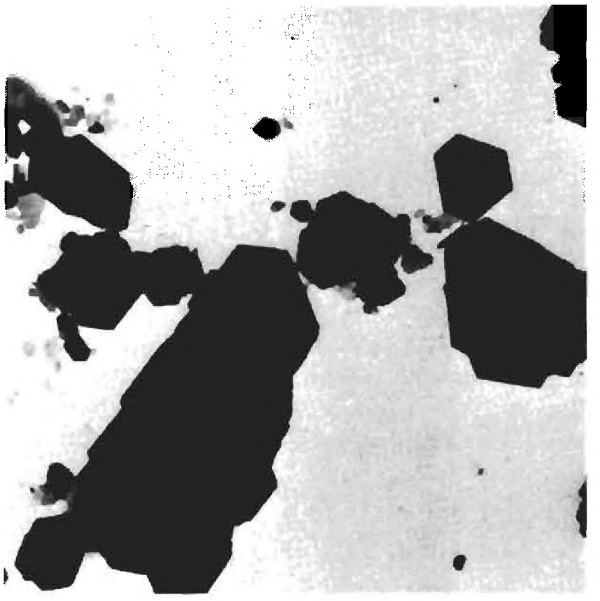


SEM 2000X

TEM 8300X

SAMPLE 00094





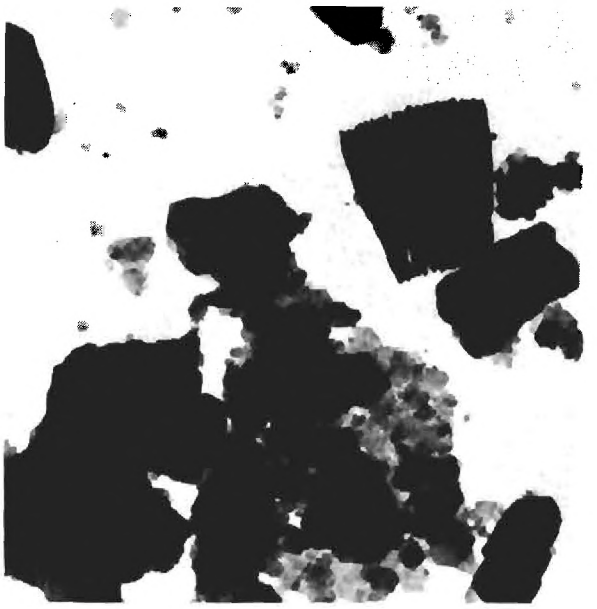
SEM 2000X

TEM 8300X

SAMPLE 00095

| SAMPLE 94 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 59' 55" | $K_2O$ | 0.37 | % |
| Longitude: | 83° 02' 25" | CaO | 0.13 | |
| Northing: | 3652500 | MgO | 0.40 | |
| Easting: | 309400 | $Al_2O_3$ | 35.18 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.31 | |
| 1/24,000 Quadrangle: | Gumm Pond | $TiO_2$ | 1.45 | |
| County: | Washington | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 290' | $Fe_2O_3$ | 0.83 | |
| Overburden Thickness: | 10' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0010 | |

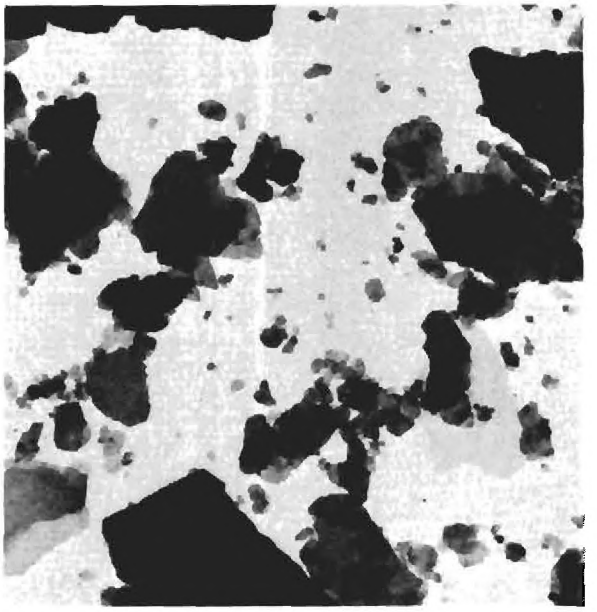
| SAMPLE 95 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 54' 20" | $K_2O$ | 0.12 | % |
| Longitude: | 83° 13' 15" | CaO | 0.03 | |
| Northing: | 3642800 | MgO | 0.60 | |
| Easting: | 292300 | $Al_2O_3$ | 34.77 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.59 | |
| 1/24,000 Quadrangle: | Napier Pond | $TiO_2$ | 1.18 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | --- | $Fe_2O_3$ | 0.77 | |
| Overburden Thickness: | --- | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0015 | |



SEM 2000X

TEM 8300X

SAMPLE 00096



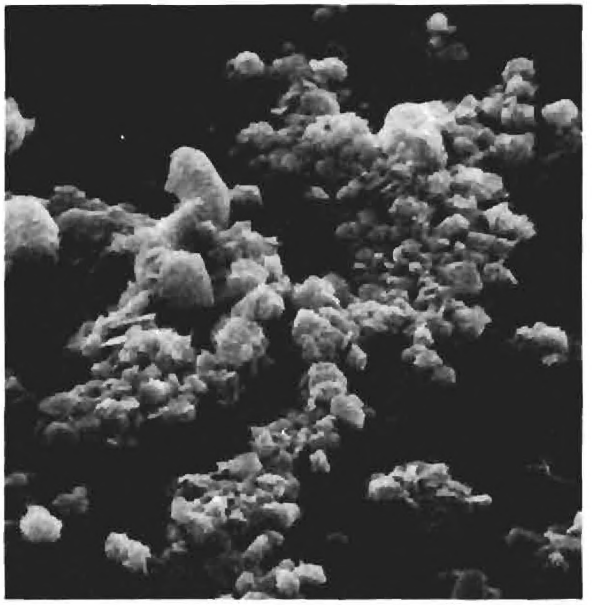
SEM 2000X

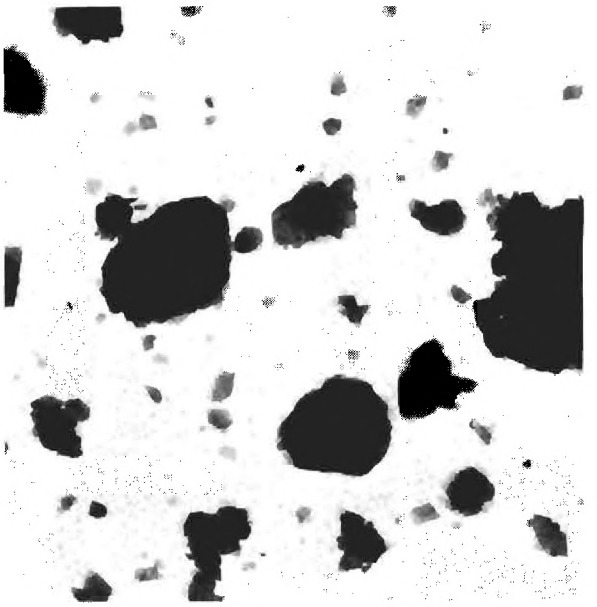
TEM 8300X

SAMPLE 00097

| SAMPLE 96 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 53' 55" | $K_2O$ | 0.16 | % |
| Longitude: | 83° 12' 15" | CaO | 0.10 | |
| Northing: | 3642050 | MgO | 0.66 | |
| Easting: | 293800 | $Al_2O_3$ | 35.56 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.42 | |
| 1/24,000 Quadrangle: | Napier Pond | $TiO_2$ | 1.48 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 430' | $Fe_2O_3$ | 0.83 | |
| Overburden Thickness: | 100' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 35' | F | 0.0015 | |

| SAMPLE 97 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 02' 55" | $K_2O$ | 0.31 | % |
| Longitude: | 83° 04' 10" | CaO | 0.06 | |
| Northing: | 3658350 | MgO | 0.46 | |
| Easting: | 306800 | $Al_2O_3$ | 35.71 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 48.69 | |
| 1/24,000 Quadrangle: | Friendship | $TiO_2$ | 1.22 | |
| County: | Baldwin | $Cr_2O_3$ | 0.10 | |
| Surface Elevation: | 430' | $Fe_2O_3$ | 0.90 | |
| Overburden Thickness: | 82' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0211 | |

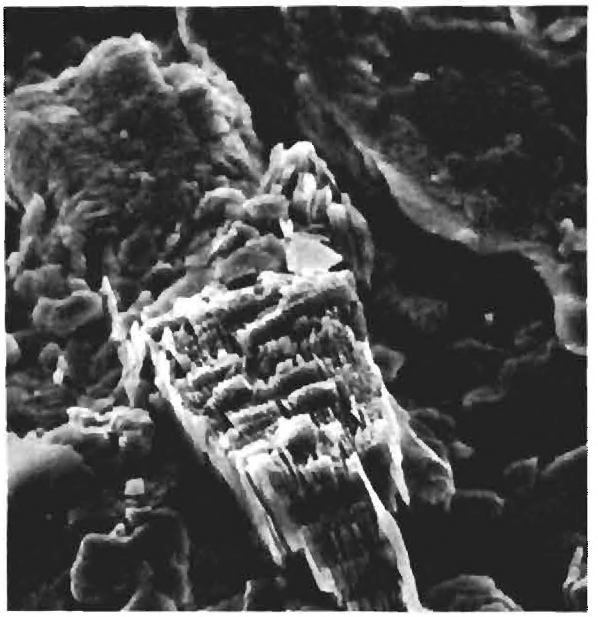




SEM 2000X

TEM 8300X

SAMPLE 00098



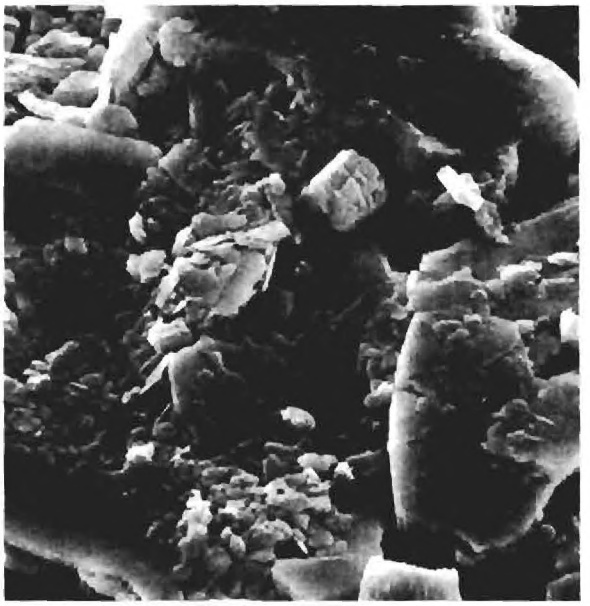
SEM 2000X

TEM 8300X

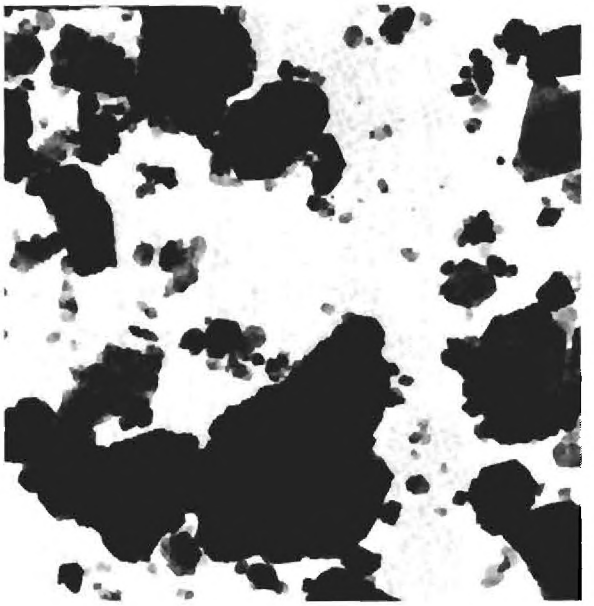
SAMPLE 00099

| SAMPLE 98 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 44' 45" | $K_2O$ | 0.11 | % |
| Longitude: | 83° 28' 45" | CaO | 0.04 | |
| Northing: | 3625650 | MgO | 0.17 | |
| Easting: | 267750 | $Al_2O_3$ | 35.98 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.93 | |
| 1/24,000 Quadrangle: | Marion | $TiO_2$ | 0.95 | |
| County: | Twiggs | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 440' | $Fe_2O_3$ | 1.02 | |
| Overburden Thickness: | 95' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 40' | F | 0.0103 | |

| SAMPLE 99 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 45' 05" | $K_2O$ | 0.13 | % |
| Longitude: | 83° 28' 10" | CaO | 0.04 | |
| Northing: | 3626300 | MgO | 1.16 | |
| Easting: | 268600 | $Al_2O_3$ | 35.20 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.61 | |
| 1/24,000 Quadrangle: | Dry Branch | $TiO_2$ | 1.80 | |
| County: | Twiggs | $Cr_2O_3$ | 1.05 | |
| Surface Elevation: | 470' | $Fe_2O_3$ | 0.90 | |
| Overburden Thickness: | 135' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0203 | |



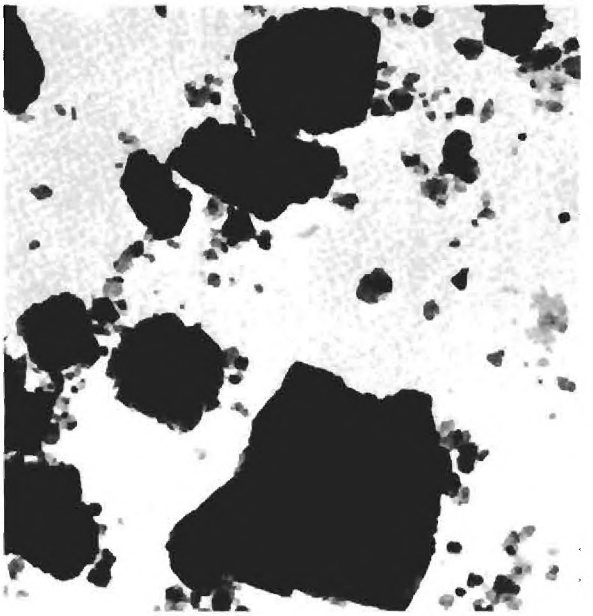
SEM 2000X



TEM 8300X

SAMPLE 00100

SEM 2000X



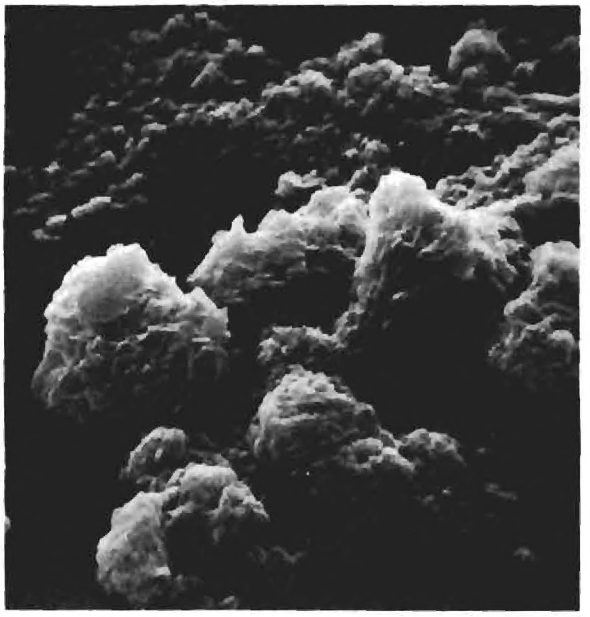
TEM 8300X

SAMPLE 00101

| SAMPLE 100 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 41' 30' | $K_2O$ | 0.14 | % |
| Longitude: | 83° 28' 40" | CaO | 0.04 | |
| Northing: | 3619650 | MgO | 0.40 | |
| Easting: | 267650 | $Al_2O_3$ | 34.50 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 47.81 | |
| 1/24,000 Quadrangle: | Marion | $TiO_2$ | 0.88 | |
| County: | Twiggs | $Cr_2O_3$ | 0.04 | |
| Surface Elevation: | 400' | $Fe_2O_3$ | 0.73 | |
| Overburden Thickness: | 140' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 40' | F | 0.0136 | |

| SAMPLE 101 | | Chemical Analyses of Selected Elements * | |
|---|---|---|---|
| Latitude: | 32° 42' 20" | $K_2O$ | NA |
| Longitude: | 83° 31' 00" | CaO | NA |
| Northing: | 3621250 | MgO | NA |
| Easting: | 264050 | $Al_2O_3$ | NA |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | NA |
| 1/24,000 Quadrangle: | Warner Robins | $TiO_2$ | NA |
| County: | Twiggs | $Cr_2O_3$ | NA |
| Surface Elevation: | 435' | $Fe_2O_3$ | NA |
| Overburden Thickness: | 38' | $P_2O_5$ | NA |
| Ore Thickness: | 30' | F | NA |

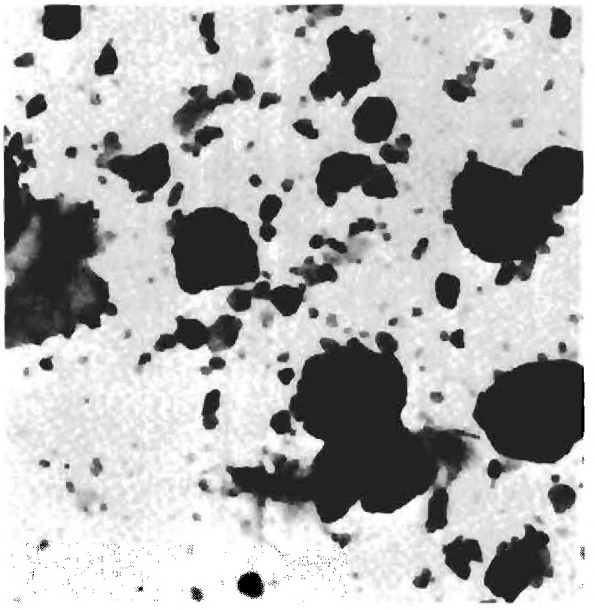
*Sample 101 not analyzed.



SEM 2000X

TEM 8300X

SAMPLE 10102



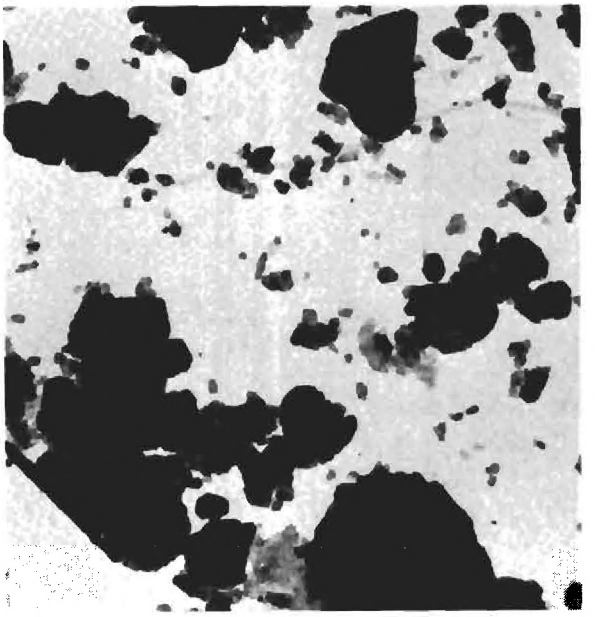
SEM 2000X

TEM 8300X

SAMPLE 00103

| SAMPLE 102 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 52' 25" | $K_2O$ | 0.23 | % |
| Longitude: | 83° 01' 00" | CaO | 1.39 | |
| Northing: | 3648450 | MgO | 1.04 | |
| Easting: | 311100 | $Al_2O_3$ | 35.64 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.33 | |
| 1/24,000 Quadrangle: | Tommsboro | $TiO_2$ | 1.95 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 365' | $Fe_2O_3$ | 1.32 | |
| Overburden Thickness: | 45' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 15' | F | 0.0204 | |

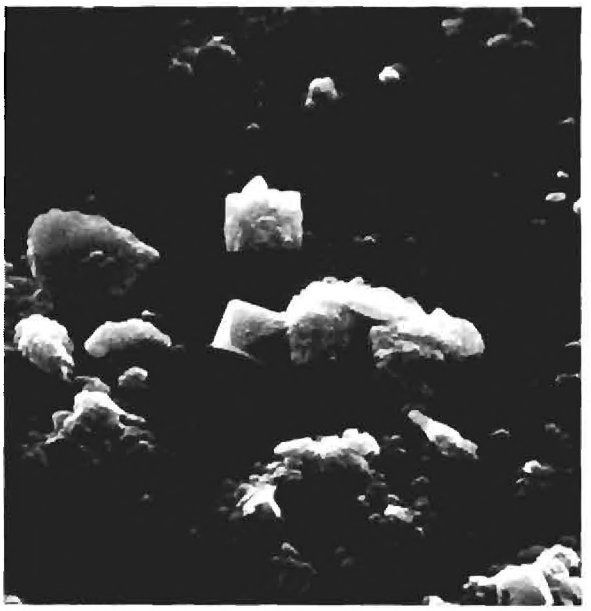
| SAMPLE 103 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 47' 32" | $K_2O$ | 0.34 | % |
| Longitude: | 83° 19' 27" | CaO | 0.08 | |
| Northing: | 3630450 | MgO | 0.12 | |
| Easting: | 282350 | $Al_2O_3$ | 35.33 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 50.02 | |
| 1/24,000 Quadrangle: | Massey Hill | $TiO_2$ | 1.08 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: | 365' | $Fe_2O_3$ | 1.04 | |
| Overburden Thickness: | 30' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | 25' | F | 0.0183 | |

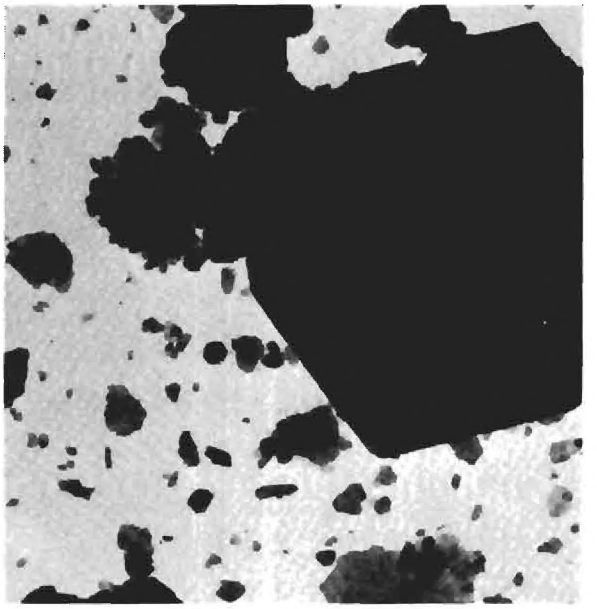


SEM 2000X

TEM 8300X

SAMPLE 00104





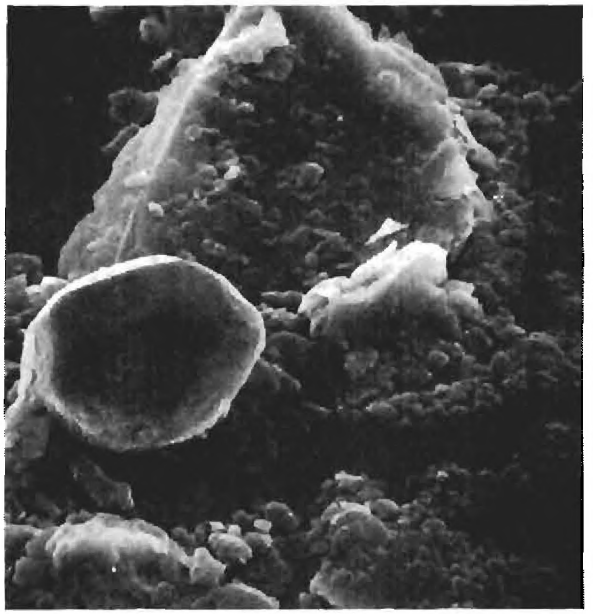
SEM 2000X

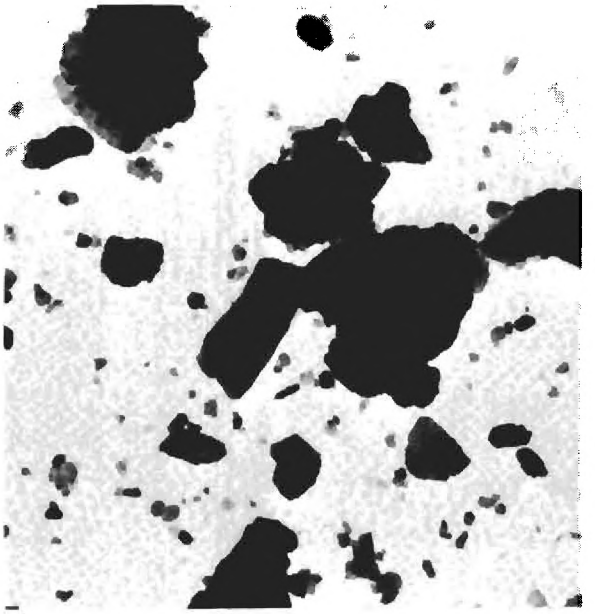
TEM 8300X

SAMPLE 00105

| SAMPLE 104 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 48' 32" | $K_2O$ | 0.30 | % |
| Longitude: | 83° 02' 58" | CaO | 0.07 | |
| Northing: | 3631820 | MgO | 0.43 | |
| Easting: | 307780 | $Al_2O_3$ | 35.20 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.03 | |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.33 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.13 | |
| Surface Elevation: | 260' | $Fe_2O_3$ | 1.14 | |
| Overburden Thickness: | 20' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | --- | F | 0.0116 | |

| SAMPLE 105 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 51' 50" | $K_2O$ | 0.34 | % |
| Longitude: | 82° 57' 25" | CaO | 0.13 | |
| Northing: | 3637700 | MgO | 0.61 | |
| Easting: | 316900 | $Al_2O_3$ | 35.58 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.90 | |
| 1/24,000 Quadrangle: | Oconee | $TiO_2$ | 1.30 | |
| County: | Washington | $Cr_2O_3$ | 0.07 | |
| Surface Elevation: | 265' | $Fe_2O_3$ | 1.02 | |
| Overburden Thickness: | 45' | $P_2O_5$ | 0.002291 | |
| Ore Thickness: | --- | F | 0.0168 | |

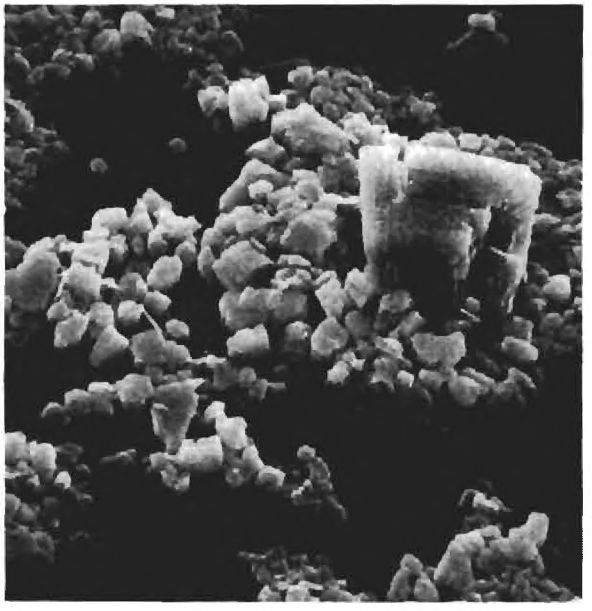


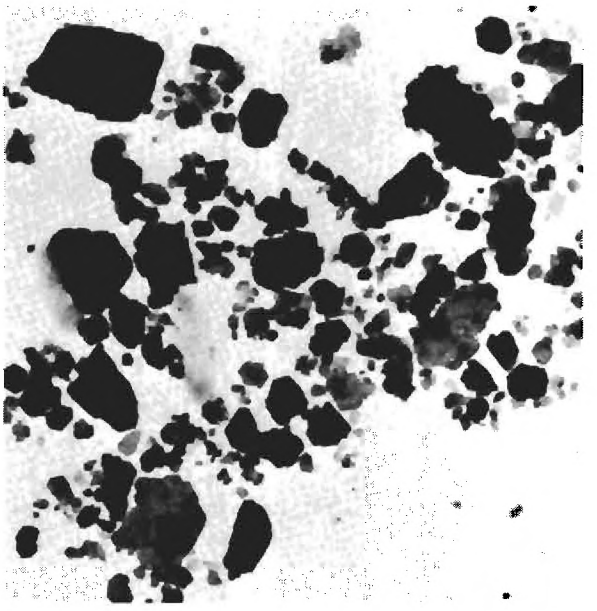


SEM 2000X

TEM 8300X

SAMPLE 00106





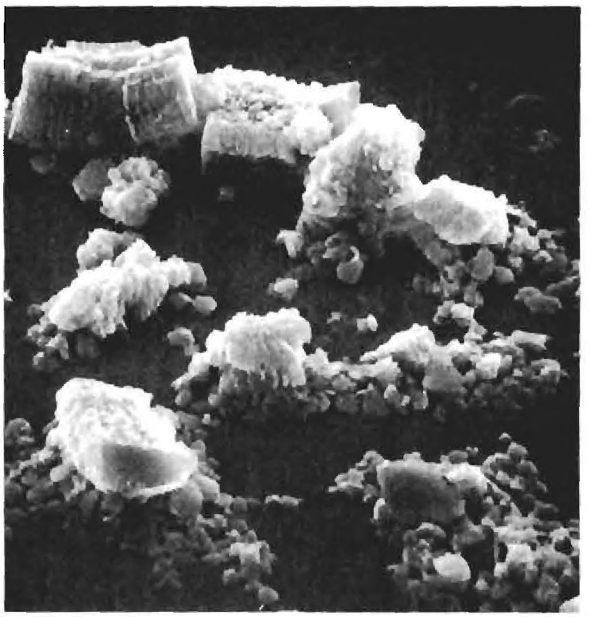
SEM 2000X

TEM 8300X

SAMPLE 00107

| SAMPLE 106 | | Chemical Analyses of Selected Elements | |
|---|---|---|---|
| Latitude: | 32° 42' 35" | $K_2O$ | NA |
| Longitude: | 83° 16' 30" | CaO | NA |
| Northing: | 3621150 | MgO | NA |
| Easting: | 286800 | $Al_2O_3$ | NA |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | NA |
| 1/24,000 Quadrangle: | Jeffersonville | $TiO_2$ | NA |
| County: | Wilkinson | $Cr_2O_3$ | NA |
| Surface Elevation: | 365' | $Fe_2O_3$ | NA |
| Overburden Thickness: | 50' | $P_2O_5$ | 0.002291 |
| Ore Thickness: | 30' | F | 0.0138 |

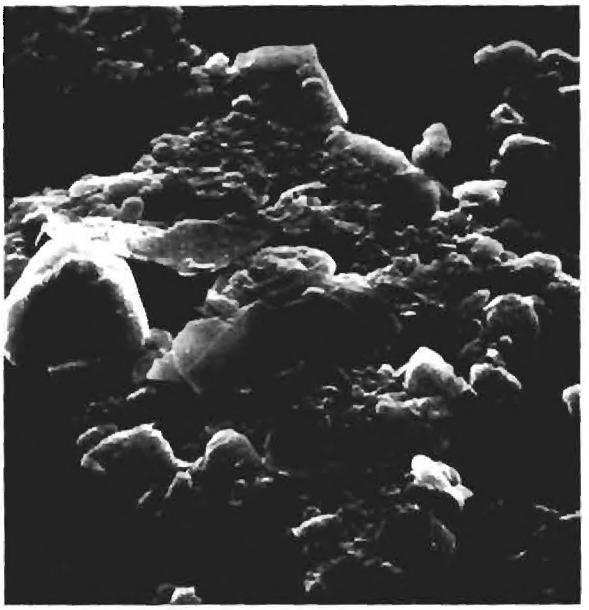
| SAMPLE 107 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 01' 50" | $K_2O$ | 0.18 | % |
| Longitude: | 82° 59' 20" | CaO | 0.07 | |
| Northing: | 3656300 | MgO | 0.65 | |
| Easting: | 314150 | $Al_2O_3$ | 35.35 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 50.89 | |
| 1/24,000 Quadrangle: | Deepstep | $TiO_2$ | 1.20 | |
| County: | Washington | $Cr_2O_3$ | 0.13 | |
| Surface Elevation: | 285' | $Fe_2O_3$ | 0.77 | |
| Overburden Thickness: | 10' | $P_2O_5$ | NA | |
| Ore Thickness: | --- | F | NA | |



SEM 2000X

TEM 8300X

SAMPLE 00108



SEM 2000X

TEM 8300X

SAMPLE 00109

| SAMPLE 108 | | Chemical Analyses of Selected Elements | |
|---|---|---|---|
| Latitude: | 32° 53' 30" | $K_2O$ | NA |
| Longitude: | 82° 59' 00" | CaO | NA |
| Northing: | 3640850 | MgO | NA |
| Easting: | 314400 | $Al_2O_3$ | NA |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | NA |
| 1/24,000 Quadrangle: | Tabernacle | $TiO_2$ | NA |
| County: | Washington | $Cr_2O_3$ | NA |
| Surface Elevation: | 265' | $Fe_2O_3$ | NA |
| Overburden Thickness: | 15' | $P_2O_5$ | NA |
| Ore Thickness: | --- | F | NA |

| SAMPLE 109 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 56' 10" | $K_2O$ | 0.54 | % |
| Longitude: | 83° 01' 50" | CaO | 0.11 | |
| Northing: | 3645800 | MgO | 0.58 | |
| Easting: | 310150 | $Al_2O_3$ | 34.77 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 47.21 | |
| 1/24,000 Quadrangle: | Gumm Pond | $TiO_2$ | 0.98 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 1.22 | |
| Overburden Thickness: | 20' | $P_2O_5$ | NA | |
| Ore Thickness: | --- | F | NA | |

SEM 2000X

TEM 8300X

SAMPLE 00110

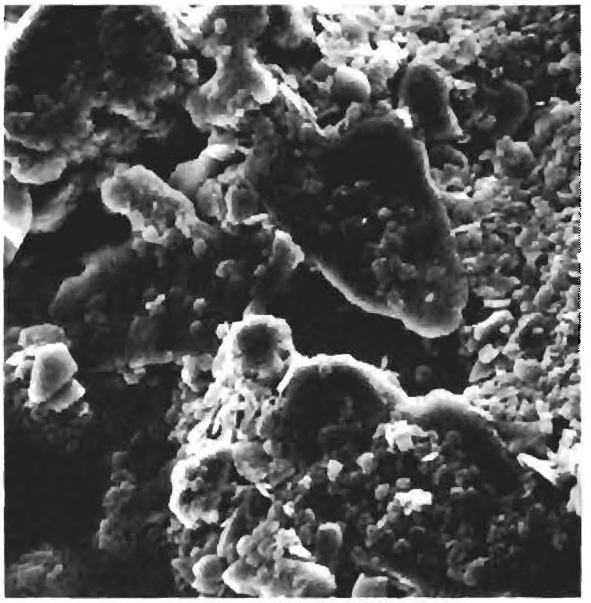
SEM 2000X

TEM 8300X

SAMPLE 10111

| SAMPLE 110 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 58' 10" | $K_2O$ | 0.28 | % |
| Longitude: | 83° 01' 00" | CaO | 0.60 | |
| Northing: | 3649550 | MgO | 0.91 | |
| Easting: | 311500 | $Al_2O_3$ | 35.79 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.52 | |
| 1/24,000 Quadrangle: | Gumm Pond | $TiO_2$ | 0.72 | |
| County: | Washington | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 320' | $Fe_2O_3$ | 0.93 | |
| Overburden Thickness: | 30' | $P_2O_5$ | NA | |
| Ore Thickness: | --- | F | NA | |

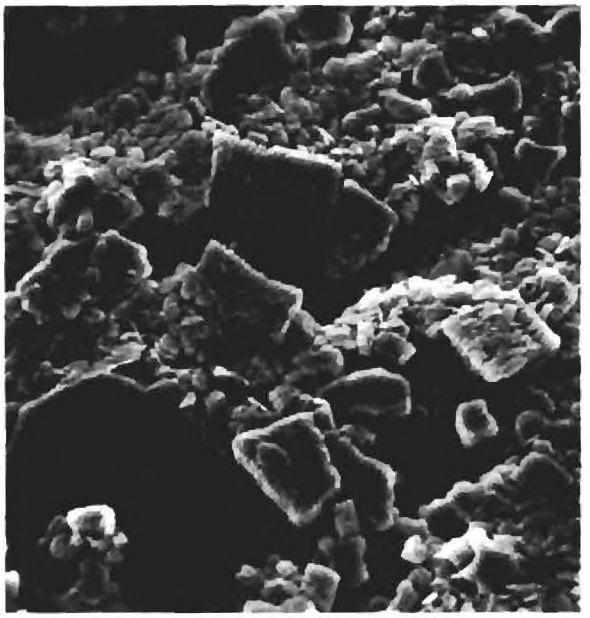
| SAMPLE 111-a | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 57' 10" | $K_2O$ | 0.22 | % |
| Longitude: | 82° 59' 55" | CaO | 0.22 | |
| Northing: | 3647600 | MgO | 1.09 | |
| Easting: | 313200 | $Al_2O_3$ | 33.56 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.57 | |
| 1/24,000 Quadrangle: | Tabernacle | $TiO_2$ | 1.42 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 0.76 | |
| Overburden Thickness: | 18' | $P_2O_5$ | NA | |
| Ore Thickness: | 9' | F | NA | |



SEM 2000X

TEM 8300X

SAMPLE 20111



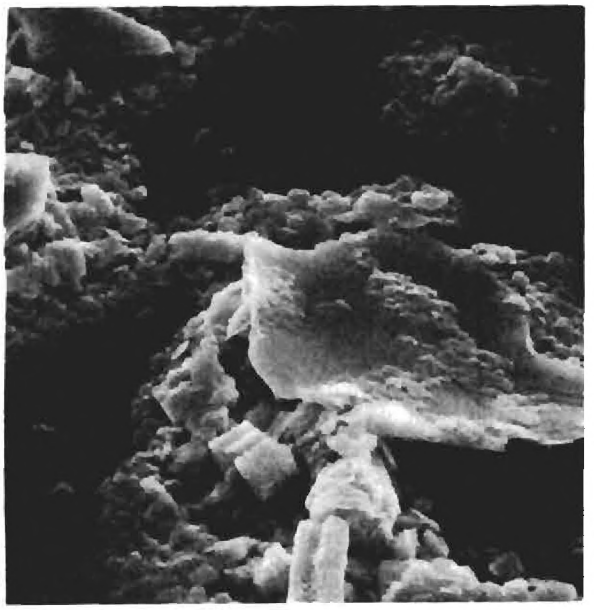
SEM 2000X

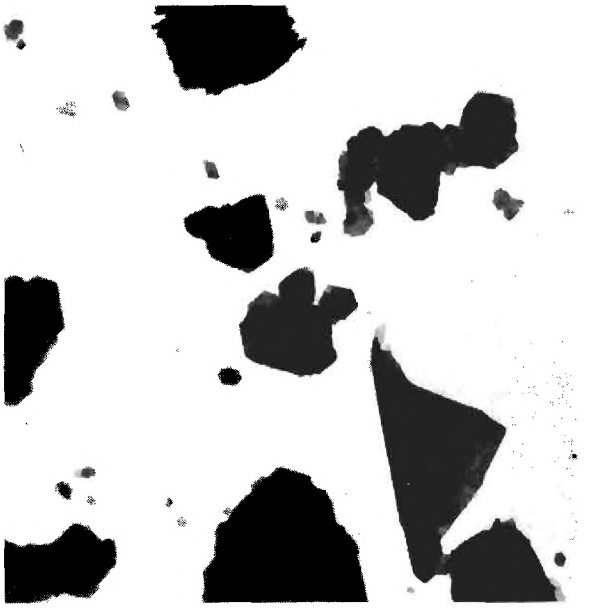
TEM 8300X

SAMPLE 30111

| SAMPLE 111-b | | Chemical Analyses of Selected Elements * | | |
|---|---|---|---|---|
| Latitude: 32° 57' 10" | | $K_2O$ | 0.22 | % |
| Longitude: 82° 59' 55" | | CaO | 0.22 | |
| Northing: 3647600 | | MgO | 1.09 | |
| Easting: 313200 | | $Al_2O_3$ | 33.56 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.57 | |
| 1/24,000 Quadrangle: | Tabernacle | $TiO_2$ | 1.42 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 0.76 | |
| Overburden Thickness: | 55' | $P_2O_5$ | NA | |
| Ore Thickness: Upper 5' of 11' Core | | F | NA | |
| | | *Analysis is a composite of total Kaolin Core for 111. | | |

| SAMPLE 111-c | | Chemical Analyses of Selected Elements * | | |
|---|---|---|---|---|
| Latitude: 32° 57' 10" | | $K_2O$ | 0.22 | % |
| Longitude: 82° 59' 55" | | CaO | 0.22 | |
| Northing: 3647600 | | MgO | 1.09 | |
| Easting: 313200 | | $Al_2O_3$ | 33.56 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.57 | |
| 1/24,000 Quadrangle: | Tabernacle | $TiO_2$ | 1.42 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 300' | $Fe_2O_3$ | 0.76 | |
| Overburden Thickness: | 55' | $P_2O_5$ | NA | |
| Ore Thickness: Lower 6' of 11' Core | | F | NA | |
| | | *Analysis is a composite of total Kaolin Core for 111. | | |

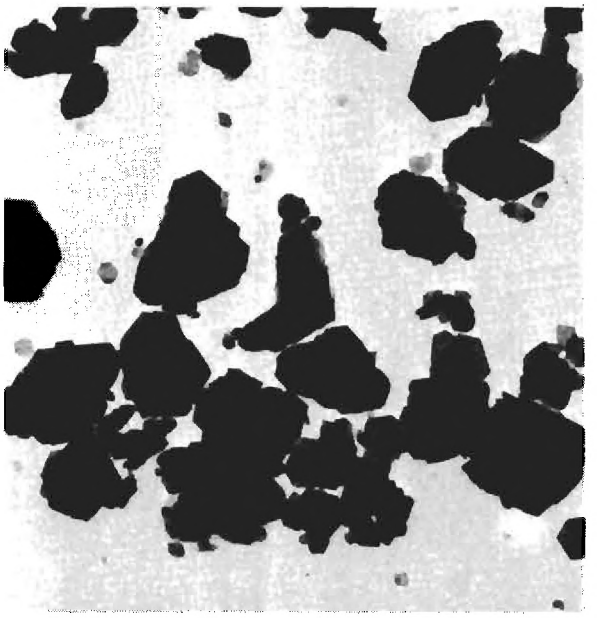




SEM 2000X

TEM 8300X

SAMPLE 00113



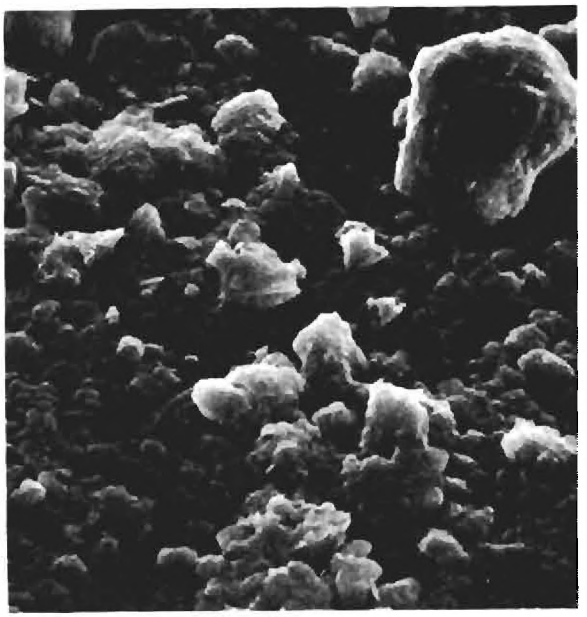
SEM 2000X

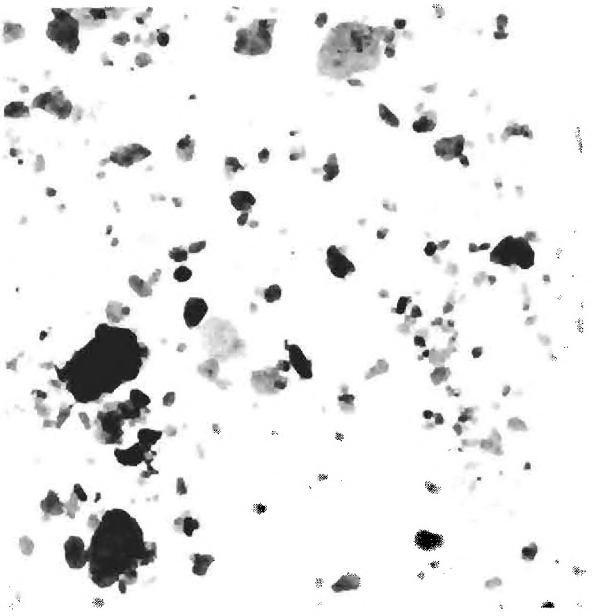
TEM 8300X

SAMPLE 00114

| SAMPLE 113 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 58' 20" | $K_2O$ | 0.33 | % |
| Longitude: | 82° 58' 55" | CaO | 0.18 | |
| Northing: | 3649700 | MgO | 1.23 | |
| Easting: | 314750 | $Al_2O_3$ | 36.24 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.18 | |
| 1/24,000 Quadrangle: | Tabernacle | $TiO_2$ | 1.25 | |
| County: | Washington | $Cr_2O_3$ | 0.09 | |
| Surface Elevation: | 285' | $Fe_2O_3$ | 0.47 | |
| Overburden Thickness: | 60' | $P_2O_5$ | NA | |
| Ore Thickness: | 11' | F | NA | |

| SAMPLE 114 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 33° 00' 40" | $K_2O$ | 0.13 | % |
| Longitude: | 82° 56' 05" | CaO | 0.39 | |
| Northing: | 3653950 | MgO | 0.63 | |
| Easting: | 319250 | $Al_2O_3$ | 34.48 | |
| 1/250,000 Quadrangle: | Athens | $SiO_2$ | 47.88 | |
| 1/24,000 Quadrangle: | Deepstep | $TiO_2$ | 1.45 | |
| County: | Washington | $Cr_2O_3$ | 0.03 | |
| Surface Elevation: | 255' | $Fe_2O_3$ | 0.89 | |
| Overburden Thickness: | 20' | $P_2O_5$ | NA | |
| Ore Thickness: | 7' | F | NA | |

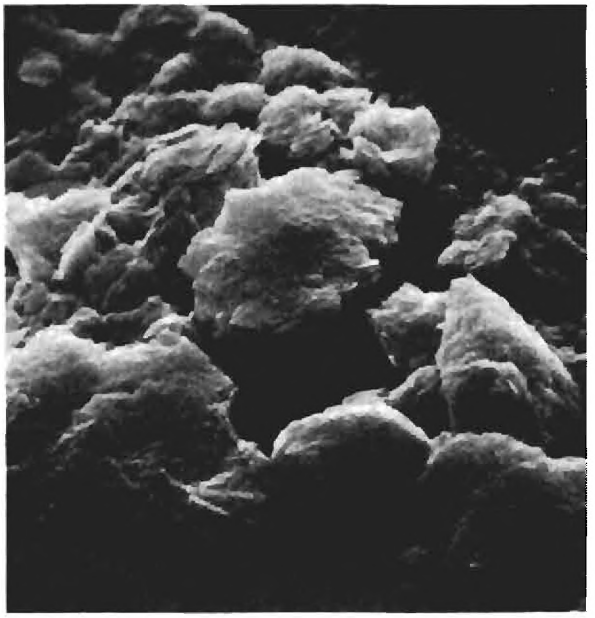


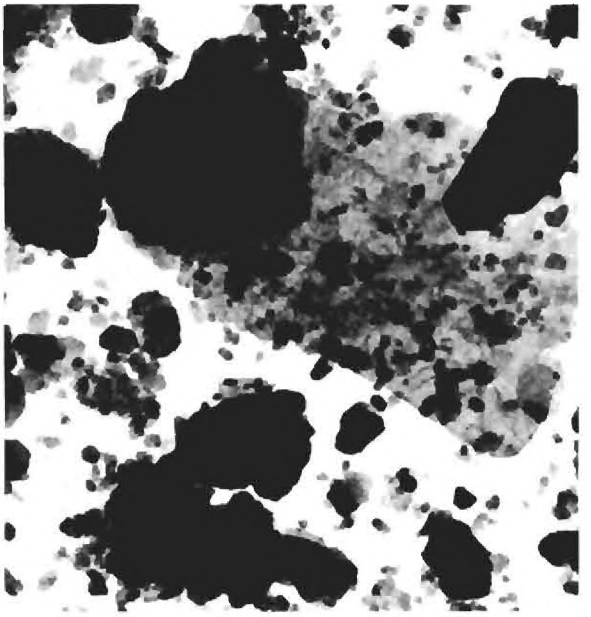


SEM 2000X

TEM 8300X

SAMPLE 00115A





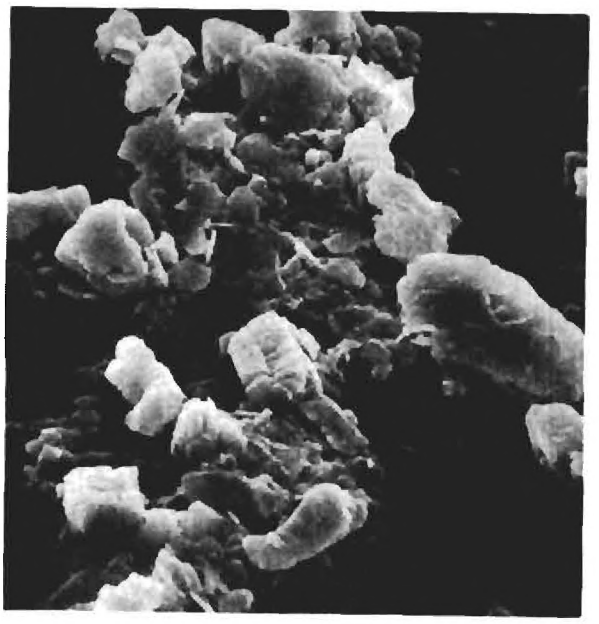
SEM 2000X

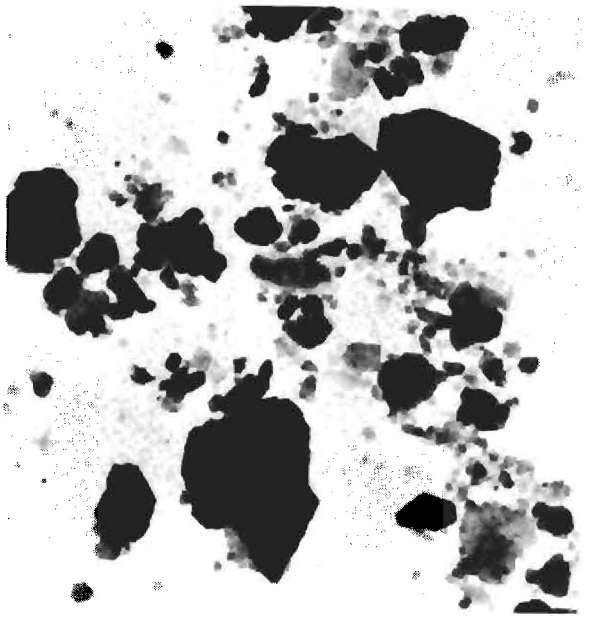
TEM 8300X

SAMPLE 00115B

| SAMPLE 115-a | Chemical Analyses of Selected Elements | | |
|---|---|---|---|
| Latitude: 33° 03' 25" | $K_2O$ | 0.33 | % |
| Longitude: 82° 38' 25" | CaO | 0.60 | |
| Northing: 3658550 | MgO | 0.88 | |
| Easting: 346850 | $Al_2O_3$ | 34.78 | |
| 1/250,000 Quadrangle: Athens | $SiO_2$ | 48.71 | |
| 1/24,000 Quadrangle: Downs | $TiO_2$ | 1.30 | |
| County: Washington | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: 380' | $Fe_2O_3$ | 0.81 | |
| Overburden Thickness: 182' | $P_2O_5$ | NA | |
| Ore Thickness: Upper 0-10' of 34' Core | F | NA | |

| SAMPLE 115-b | Chemical Analyses of Selected Elements | | |
|---|---|---|---|
| Latitude: 33° 03' 25" | $K_2O$ | 0.33 | % |
| Longitude: 82° 38' 25" | CaO | 0.60 | |
| Northing: 3658550 | MgO | 0.88 | |
| Easting: 346850 | $Al_2O_3$ | 34.78 | |
| 1/250,000 Quadrangle: Athens | $SiO_2$ | 48.71 | |
| 1/24,000 Quadrangle: Downs | $TiO_2$ | 1.30 | |
| County: Washington | $Cr_2O_3$ | 0.01 | |
| Surface Elevation: 380' | $Fe_2O_3$ | 0.81 | |
| Overburden Thickness: 182' | $P_2O_5$ | NA | |
| Ore Thickness: Lower 26-34' of 34' Core | F | NA | |

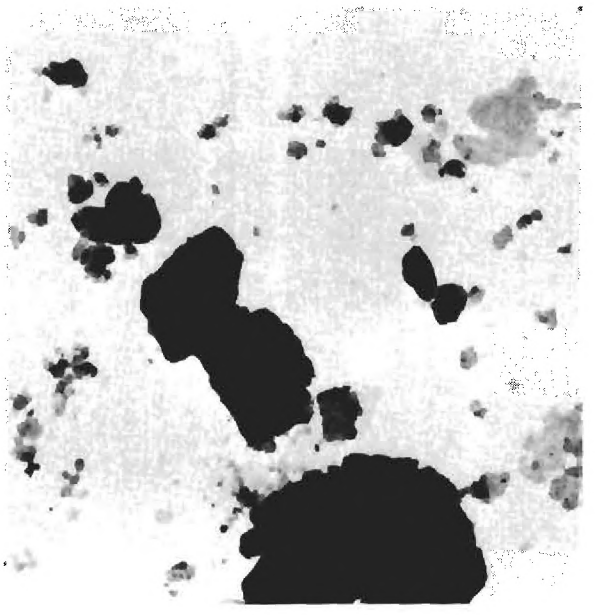




SEM 2000X

TEM 8300X

SAMPLE 00116



SEM 2000X

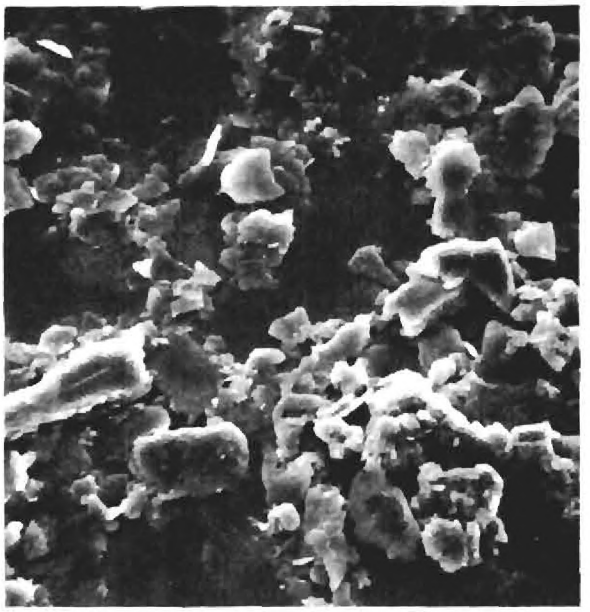
TEM 8300X

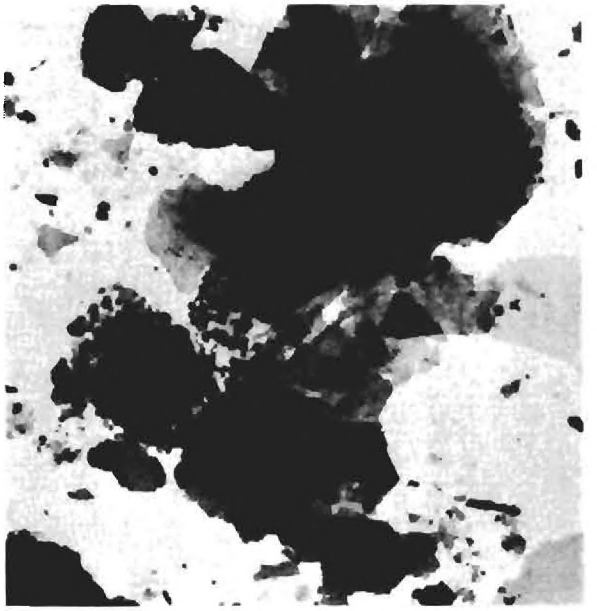
SAMPLE 10117

| SAMPLE 116 | | Chemical Analyses of Selected Elements | | |
|---|---|---|---|---|
| Latitude: | 32° 16' 25" | $K_2O$ | 0.30 | % |
| Longitude: | 84° 11' 50" | CaO | 1.06 | |
| Northing: | 3578900 | MgO | 1.19 | |
| Easting: | 764000 | $Al_2O_3$ | 35.60 | |
| 1/250,000 Quadrangle: | Phoenix City | $SiO_2$ | 48.78 | |
| 1/24,000 Quadrangle: | Ideal South | $TiO_2$ | 1.18 | |
| County: | Macon | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 400' | $Fe_2O_3$ | 1.07 | |
| Overburden Thickness: | 29' | $P_2O_5$ | NA | |
| Ore Thickness: | 20' | F | NA | |

| SAMPLE 117-a | | Chemical Analyses of Selected Elements * | | |
|---|---|---|---|---|
| Latitude: | 32° 51' 17" | $K_2O$ | 0.34 | % |
| Longitude: | 83° 07' 15" | CaO | 0.64 | |
| Northing: | 3637000 | MgO | 0.99 | |
| Easting: | 301540 | $Al_2O_3$ | 35.94 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.25 | |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.23 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.92 | |
| Surface Elevation: | 277' | $Fe_2O_3$ | 8.51 | |
| Overburden Thickness: | 14' | $P_2O_5$ | NA | |
| Ore Thickness: | Upper 41' of 46' Core | F | NA | |

*Composite of total Kaolin Core for 117.

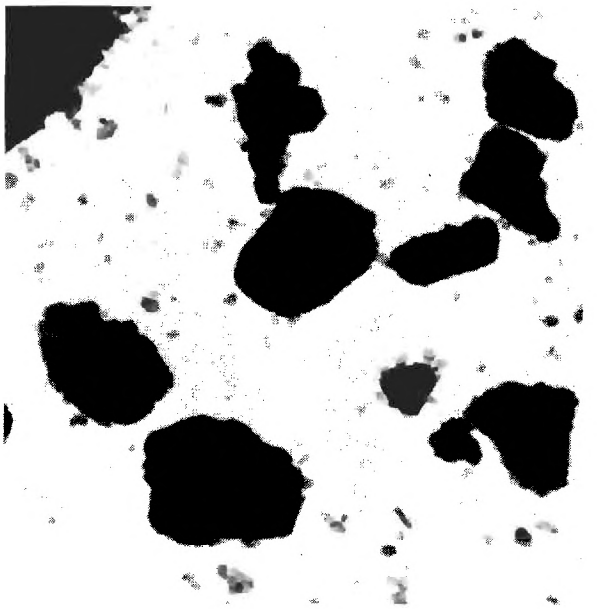




SEM 2000X

TEM 8300X

SAMPLE 20117



SEM 2000X

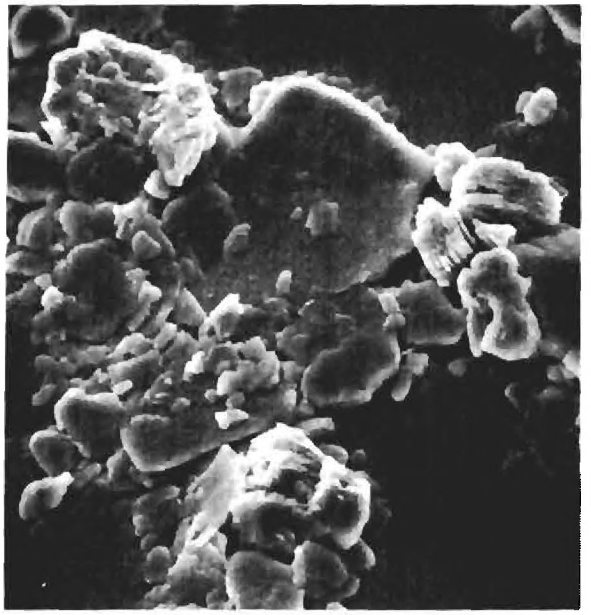
TEM 8300X

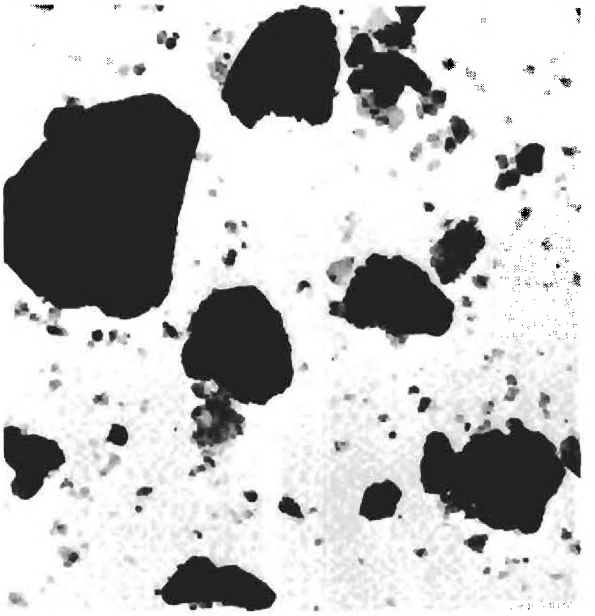
SAMPLE 00118

| SAMPLE 117-b | | Chemical Analyses of Selected Elements * | |
|---|---|---|---|
| Latitude: | 32° 51' 17" | $K_2O$ | 0.34 % |
| Longitude: | 83° 07' 15" | CaO | 0.64 |
| Northing: | 3637000 | MgO | 0.99 |
| Easting: | 301540 | $Al_2O_3$ | 35.94 |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.25 |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.23 |
| County: | Wilkinson | $Cr_2O_3$ | 0.92 |
| Surface Elevation: | 277' | $Fe_2O_3$ | 8.51 |
| Overburden Thickness: | 14' | $P_2O_5$ | NA |
| Ore Thickness: | Lower 5" of 46' Core | F | NA |

*Composite of total Kaolin Core for 117.

| SAMPLE 118 | | Chemical Analyses of Selected Elements | |
|---|---|---|---|
| Latitude: | 32° 50' 33" | $K_2O$ | 0.31 % |
| Longitude: | 83° 05' 28" | CaO | 0.06 |
| Northing: | 3635570 | MgO | 0.41 |
| Easting: | 304290 | $Al_2O_3$ | 35.82 |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 48.24 |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.18 |
| County: | Wilkinson | $Cr_2O_3$ | 0.06 |
| Surface Elevation: | 298' | $Fe_2O_3$ | 2.53 |
| Overburden Thickness: | 16' | $P_2O_5$ | NA |
| Ore Thickness: | 60' | F | NA |

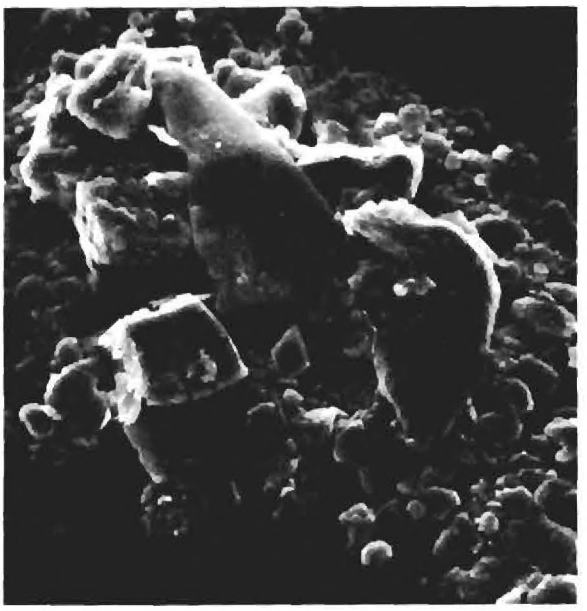


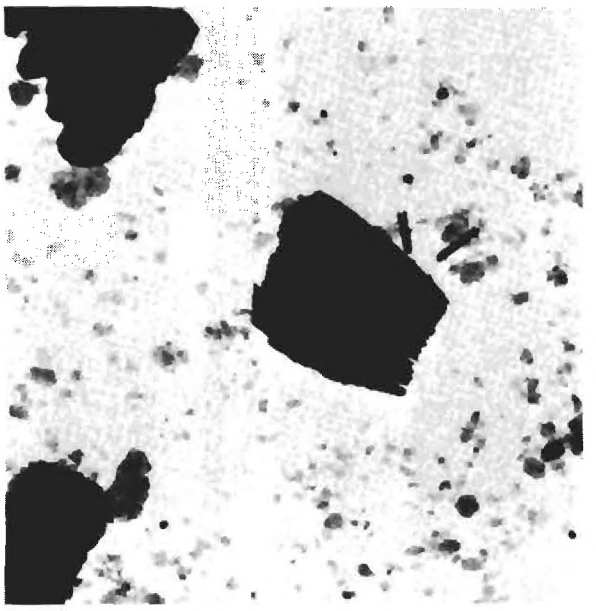


SEM 2000X

TEM 8300X

SAMPLE 10119





SEM 2000X

TEM 8300X

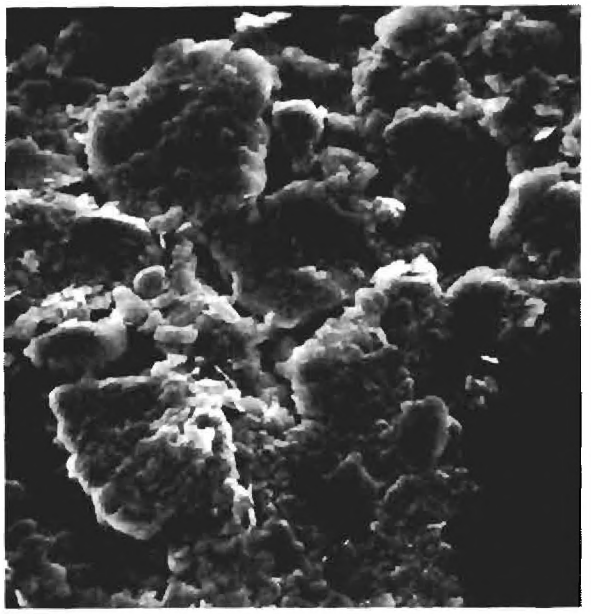
SAMPLE 20119

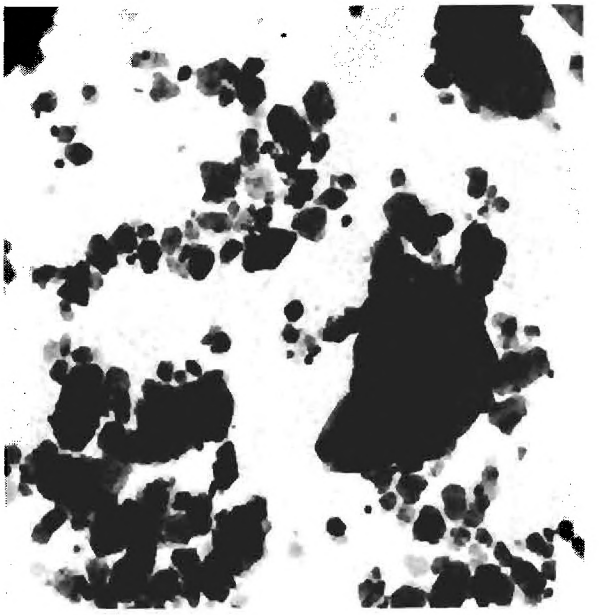
| SAMPLE 119-a | | Chemical Analyses of Selected Elements* | | |
|---|---|---|---|---|
| Latitude: | 32° 47' 50" | $K_2O$ | 1.06 | % |
| Longitude: | 83° 04' 00" | CaO | 0.06 | |
| Northing: | 3630500 | MgO | 0.86 | |
| Easting: | 306480 | $Al_2O_3$ | 35.88 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.01 | |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.13 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 266' | $Fe_2O_3$ | 1.42 | |
| Overburden Thickness: | 43' | $P_2O_5$ | NA | |
| Ore Thickness: | Upper 54' of 109' Core | F | NA | |

*Composite of total Kaolin Core for 119-a and 119-b.

| SAMPLE 119-b | | Chemical Analyses of Selected Elements * | | |
|---|---|---|---|---|
| Latitude: | 32° 47' 50" | $K_2O$ | 1.06 | % |
| Longitude: | 83° 04' 00" | CaO | 0.06 | |
| Northing: | 3630500 | MgO | 0.86 | |
| Easting: | 306480 | $Al_2O_3$ | 35.88 | |
| 1/250,000 Quadrangle: | Macon | $SiO_2$ | 49.01 | |
| 1/24,000 Quadrangle: | Toomsboro | $TiO_2$ | 1.13 | |
| County: | Wilkinson | $Cr_2O_3$ | 0.06 | |
| Surface Elevation: | 266' | $Fe_2O_3$ | 1.42 | |
| Overburden Thickness: | 43' | $P_2O_5$ | NA | |
| Ore Thickness: | Lower 55' of 109' Core | F | NA | |

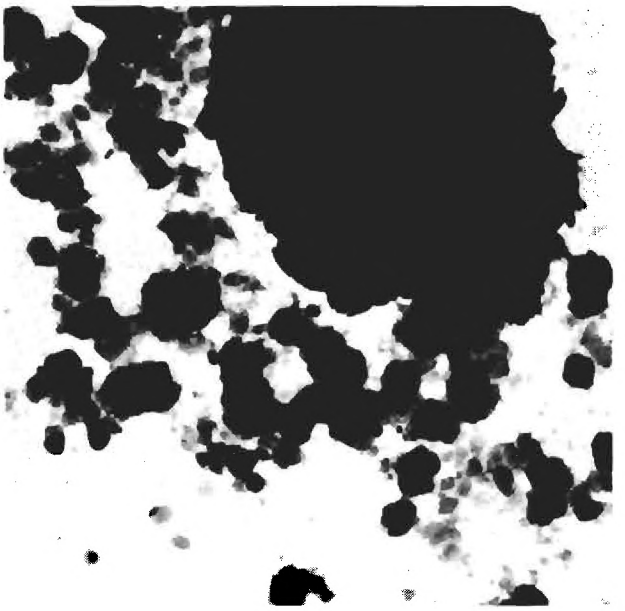
*Composite of total Kaolin Core for 119-a and 119-b.





SEM 2000X TEM 8300X

SAMPLE 10120



SEM 2000X TEM 8300X

SAMPLE 20120

| SAMPLE 120-a | Chemical Analyses of Selected Elements* | |
|---|---|---|
| Latitude: 32° 52' 40" | $K_2O$ | 0.30 % |
| Longitude: 83° 08' 20" | CaO | 0.39 |
| Northing: 3639500 | MgO | 1.19 |
| Easting: 299870 | $Al_2O_3$ | 36.20 |
| 1/250,000 Quadrangle: Macon | $SiO_2$ | 48.22 |
| 1/24,000 Quadrangle: Napier Pond | $TiO_2$ | 2.25 |
| County: Wilkinson | $Cr_2O_3$ | 0.12 |
| Surface Elevation: 315' | $Fe_2O_3$ | 1.40 |
| Overburden Thickness: 3' | $P_2O_5$ | NA |
| Ore Thickness: Upper 10' of 40' Core | F | NA |

*Composite of total Kaolin Core for 120-a and 120-b

| SAMPLE 120-b | Chemical Analyses of Selected Elements | |
|---|---|---|
| Latitude: 32° 52' 40" | $K_2O$ | 0.30 % |
| Longitude: 83° 08' 20" | CaO | 0.39 |
| Northing: 3639550 | MgO | 1.19 |
| Easting: 299870 | $Al_2O_3$ | 36.20 |
| 1/250,000 Quadrangle: Macon | $SiO_2$ | 48.22 |
| 1/24,000 Quadrangle: Napier Pond | $TiO_2$ | 2.25 |
| County: Wilkinson | $Cr_2O_3$ | 0.12 |
| Surface Elevation: 315' | $Fe_2O_3$ | 1.40 |
| Overburden Thickness: 3' | $P_2O_5$ | NA |
| Ore Thickness: Lower 30' of 40' Core | F | NA |

*Composite of total Kaolin Core for 120-a and 120-b.

# Appendix 3

## Cross Reference of Analyses of $Fe_2O_3$, $Cr_2O_3$, $TiO_2$, $SiO_2$, $Al_2O_3$, MgO, CaO, $K_2O$, F, and $P_2O_5$

| Sample Number | $K_2O$ | CaO | MgO | $Al_2O_3$ | $SiO_2$ | $T_iO_2$ | $Cr_2O_3$ | $Fe_2O_3$ | $P_2O_5$ | F |
|---|---|---|---|---|---|---|---|---|---|---|
| 001 | 0.35 | 0.03 | 0.90 | 34.58 | 49.35 | 1.20 | 0.03 | 1.20 | 0.000458 | 0.0137 |
| 002 | 0.37 | 0.06 | 0.65 | 36.03 | 48.41 | 1.18 | 0.06 | 1.14 | 0.103111 | 0.0105 |
| 003 | 0.41 | 0.10 | 1.23 | 34.96 | 48.69 | 1.48 | 0.07 | 0.89 | 0.048119 | 0.0084 |
| 004 | 0.19 | 0.06 | 1.09 | 36.03 | 46.15 | 1.17 | 0.01 | 0.56 | 0.258924 | 0.0061 |
| 005 | 0.20 | 0.14 | 0.76 | 36.41 | 48.39 | 1.30 | 0.01 | 0.79 | 0.057284 | 0.0060 |
| 006 | 0.22 | 0.07 | 0.15 | 38.43 | 44.99 | 1.28 | 0.01 | 0.76 | 0.103111 | 0.0063 |
| 007 | 0.19 | 0.15 | 0.76 | 37.86 | 45.97 | 1.07 | 0.04 | 1.83 | 0.006874 | 0.0056 |
| 008 | 0.16 | 0.06 | 0.18 | 36.39 | 47.84 | 0.47 | 0.04 | 0.81 | 0.004583 | 0.0049 |
| 009 | 0.11 | 0.11 | 0.73 | 38.92 | 45.59 | 0.87 | 0.06 | 0.73 | 0.022914 | 0.0121 |
| 010 | 0.10 | 0.28 | 0.63 | 34.48 | 50.79 | 1.50 | 0.01 | 0.99 | 0.006874 | 0.0054 |
| 011 | 0.11 | 0.20 | 0.28 | 37.68 | 45.63 | 1.02 | 0.01 | 1.04 | 0.034370 | 0.0018 |
| 012 | 0.46 | 0.08 | 0.73 | 35.37 | 49.35 | 2.62 | 0.01 | 0.67 | 0.009165 | 0.0026 |
| 013 | 0.17 | 0.21 | 0.53 | 34.99 | 45.70 | 0.95 | 0.03 | 0.89 | 0.018331 | 0.0075 |
| 014 | 0.23 | 0.17 | 0.99 | 36.64 | 43.81 | 2.97 | 0.03 | 0.87 | 0.009165 | 0.0060 |
| 015 | 0.17 | 0.06 | 1.19 | 35.88 | 48.20 | 0.85 | 0.10 | 0.70 | 0.006874 | 0.0092 |
| 016 | 0.39 | 0.50 | 0.43 | 34.96 | 47.17 | 0.95 | 0.04 | 1.00 | 0.286420 | 0.0052 |
| 017 | 0.82 | 0.15 | 0.33 | 37.30 | 48.97 | 1.48 | 0.06 | 1.17 | 0.006874 | 0.0023 |
| 018 | 0.65 | 0.25 | 0.55 | 36.66 | 48.63 | 1.03 | 0.04 | 0.90 | 0.018331 | 0.0097 |
| 019 | 0.19 | 0.85 | 0.27 | 35.62 | 47.64 | 0.98 | 0.06 | 1.24 | 0.011457 | 0.0099 |
| 020 | 0.12 | 1.02 | 0.80 | 36.90 | 48.56 | 1.63 | 0.06 | 1.37 | 0.064158 | 0.0085 |
| 021 | 0.46 | 0.07 | 0.46 | 33.86 | 46.15 | 0.93 | 0.01 | 1.00 | 0.009165 | 0.0056 |
| 022 | 0.18 | 0.14 | 0.73 | 34.96 | 46.66 | 1.37 | 0.07 | 0.61 | 0.004583 | 0.0049 |
| 023 | 0.18 | 0.01 | 0.63 | 35.22 | 48.80 | 1.25 | 0.03 | 0.94 | 0.000917 | 0.0065 |
| 024 | 0.19 | 1.33 | 0.15 | 34.18 | 45.70 | 2.20 | 0.10 | 0.56 | 0.006874 | 0.0065 |
| 025 | 0.10 | 0.21 | 0.51 | 35.39 | 48.54 | 1.40 | 0.09 | 1.16 | 0.032079 | 0.0057 |
| 026 | 0.65 | 0.20 | 0.65 | 35.62 | 49.35 | 1.23 | 0.03 | 1.04 | 0.009165 | 0.0126 |
| 027 | 0.87 | 0.13 | 0.71 | 34.88 | 49.76 | 0.97 | 0.07 | 0.67 | 0.006874 | 0.0072 |
| 028 | 0.18 | 1.71 | 1.58 | 35.60 | 49.50 | 2.74 | 0.10 | 1.00 | 0.006874 | 0.0042 |
| 029 | 0.11 | 1.43 | 1.31 | 35.65 | 47.30 | 0.78 | 0.01 | 0.77 | 0.009165 | 0.0055 |
| 030 | 0.34 | 1.62 | 1.29 | 36.15 | 45.78 | 0.55 | 0.04 | 1.44 | 0.009165 | 0.0055 |
| 031 | 0.23 | 0.07 | 0.76 | 35.43 | 46.57 | 1.38 | 0.10 | 1.16 | 0.006874 | 0.0055 |
| 032 | 0.59 | 0.08 | 0.96 | 35.14 | 47.13 | 0.92 | 0.06 | 1.10 | 0.011457 | 0.0069 |

| Sample Number | $K_2O$ | CaO | MgO | $Al_2O_3$ | $SiO_2$ | $T_iO_2$ | $Cr_2O_3$ | $Fe_2O_3$ | $P_2O_5$ | F |
|---|---|---|---|---|---|---|---|---|---|---|
| 033 | 0.10 | 0.07 | 0.95 | 33.92 | 45.97 | 1.18 | 0.04 | 1.19 | 0.009165 | 0.0051 |
| 034 | 0.18 | 0.10 | 1.08 | 35.01 | 46.40 | 1.23 | 0.01 | 0.83 | 0.009165 | 0.0037 |
| 035 | 0.10 | 0.06 | 0.76 | 34.37 | 46.79 | 0.85 | 0.01 | 0.46 | 0.009165 | 0.0041 |
| 036 | 0.22 | 0.08 | 0.45 | 36.83 | 47.32 | 0.93 | 0.12 | 0.57 | 0.000687 | 0.0061 |
| 037 | 0.72 | 0.10 | 0.80 | 35.35 | 48.84 | 0.97 | 0.04 | 2.70 | 0.121442 | 0.0041 |
| 038 | 0.23 | NA | 0.78 | 36.03 | 46.94 | 3.27 | 0.04 | 1.24 | 0.009165 | 0.0048 |
| 039 | 0.42 | 0.11 | 0.30 | 34.90 | 47.75 | 1.08 | 0.19 | 1.27 | 0.009165 | 0.0081 |
| 040 | 0.65 | 0.32 | 0.45 | 34.22 | 47.54 | 1.43 | 0.06 | 1.42 | 0.009165 | 0.0039 |
| 041 | 0.24 | 0.08 | 0.28 | 36.07 | 47.15 | 0.92 | 0.04 | 0.71 | 0.009165 | 0.0091 |
| 042 | 0.20 | 0.25 | 0.45 | 35.81 | 49.59 | 1.28 | 0.04 | 0.97 | 0.006874 | 0.0082 |
| 043 | 0.47 | 0.15 | 0.65 | 36.22 | 48.24 | 1.45 | 0.04 | 0.69 | 0.011457 | 0.0055 |
| 044 | 0.95 | 0.31 | 0.81 | 36.49 | 49.40 | 1.40 | 0.10 | 0.97 | 0.004583 | 0.0036 |
| 045 | 0.33 | 1.57 | 1.43 | 35.84 | 49.42 | 1.45 | 0.03 | 1.33 | 0.004583 | 0.0043 |
| 046 | 0.41 | 0.03 | 0.12 | 35.82 | 47.54 | 1.15 | 0.01 | 0.50 | 0.002291 | 0.0054 |
| 047 | 0.22 | 0.10 | 0.56 | 33.97 | 49.25 | 0.85 | 0.06 | 0.71 | 0.004583 | 0.0042 |
| 048 | 0.22 | 0.22 | 0.58 | 36.35 | 48.99 | 1.60 | 0.28 | 1.22 | 0.004583 | 0.0057 |
| 049 | 0.49 | 0.07 | 0.15 | 34.39 | 46.55 | 1.13 | 0.01 | 0.94 | 0.004583 | 0.0035 |
| 050 | 0.58 | 0.31 | 0.25 | 35.24 | 49.03 | 1.13 | 0.04 | 0.76 | 0.002291 | 0.0028 |
| 051 | 0.33 | 0.14 | 0.18 | 35.48 | 48.97 | 1.35 | 0.04 | 0.71 | 0.004583 | 0.0042 |
| 052 | 0.36 | 0.14 | 0.25 | 35.86 | 48.71 | 1.30 | 0.01 | 1.44 | 0.004583 | 0.0021 |
| 053 | 0.06 | 0.06 | 0.20 | 35.60 | 48.20 | 1.12 | 0.06 | 1.12 | 0.004583 | 0.0044 |
| 054 | 0.31 | 0.17 | 0.78 | 35.82 | 47.88 | 2.04 | 0.04 | 1.33 | 0.002291 | 0.0032 |
| 055 | 0.65 | 0.13 | 0.53 | 36.07 | 48.07 | 0.88 | 0.06 | 1.30 | 0.004583 | 0.0026 |
| 056 | 0.33 | 0.08 | 1.72 | 34.60 | 48.26 | 0.90 | 0.04 | 0.59 | 0.004583 | 0.0035 |
| 057 | 0.10 | 0.03 | 0.33 | 34.61 | 46.83 | 0.55 | 0.01 | 0.41 | 0.006874 | 0.0021 |
| 058 | 0.67 | 0.22 | 0.15 | 34.96 | 47.94 | 0.95 | 0.06 | 1.12 | 0.011457 | 0.0026 |
| 059 | 0.11 | 0.06 | 0.20 | 35.86 | 52.88 | 0.58 | 0.06 | 0.46 | 0.006874 | 0.0025 |
| 060 | 0.11 | 0.39 | 0.15 | 35.13 | 50.02 | 1.27 | 0.03 | 1.22 | 0.004583 | 0.0048 |
| 061 | 0.05 | 0.04 | 0.23 | 34.99 | 46.83 | 1.20 | 0.03 | 0.43 | 0.004583 | 0.0036 |
| 062 | 0.88 | 0.03 | 0.15 | 34.99 | 48.86 | 1.08 | 0.03 | 0.46 | 0.006874 | 0.0038 |
| 063 | 0.64 | 0.06 | 0.27 | 35.54 | 49.01 | 0.83 | 0.01 | 0.51 | 0.004583 | 0.0025 |
| 064 | 0.16 | 0.04 | 0.23 | 35.09 | 47.88 | 1.02 | 0.01 | 0.56 | 0.009165 | 0.0026 |

| Sample Number | $K_2O$ | CaO | MgO | $Al_2O_3$ | $SiO_2$ | $T_iO_2$ | $Cr_2O_3$ | $Fe_2O_3$ | $P_2O_5$ | F |
|---|---|---|---|---|---|---|---|---|---|---|
| 065 | 0.75 | 0.27 | 0.58 | 35.39 | 47.84 | 0.93 | 0.01 | 0.43 | 0.002291 | 0.0033 |
| 066 | 0.07 | 0.17 | 0.18 | 33.27 | 50.10 | 1.20 | 0.01 | 0.47 | 0.004583 | 0.0033 |
| 067 | 0.87 | 0.28 | 0.83 | 34.18 | 48.99 | 1.08 | 0.06 | 1.19 | 0.002291 | 0.0028 |
| 068 | 0.33 | 0.24 | 0.65 | 36.43 | 48.43 | 1.67 | 0.01 | 1.19 | 0.004583 | 0.0026 |
| 069 | 0.22 | 0.10 | 0.25 | 37.96 | 45.55 | 0.88 | 0.01 | 0.61 | 0.004583 | 0.0048 |
| 070 | 0.54 | 0.15 | 0.99 | 34.97 | 48.56 | 2.65 | 0.01 | 1.49 | 0.004583 | 0.0023 |
| 071 | 0.48 | 0.31 | 0.66 | 34.05 | 47.81 | 0.92 | 0.07 | 0.86 | 0.002291 | 0.0026 |
| 072 | 0.53 | 0.29 | 0.86 | 35.84 | 45.85 | 1.27 | 0.01 | 1.44 | 0.002291 | 0.0038 |
| 073 | 0.69 | 0.34 | 0.28 | 35.30 | 48.20 | 1.53 | 0.12 | 0.73 | 0.002291 | 0.0024 |
| 074 | 0.41 | 0.20 | 0.55 | 36.18 | 48.11 | 1.25 | 0.03 | 1.06 | 0.009165 | 0.0031 |
| 075 | 0.29 | 3.02 | 0.73 | 35.13 | 47.98 | 0.97 | 0.03 | 0.94 | 0.002291 | 0.0026 |
| 076 | 0.49 | 0.31 | 0.83 | 34.07 | 49.95 | 0.88 | 0.09 | 1.29 | 0.002291 | 0.0029 |
| 077 | 0.70 | 0.22 | 0.91 | 35.13 | 49.35 | 1.43 | 0.07 | 1.20 | 0.002291 | 0.0037 |
| 078 | 0.25 | 0.43 | 0.76 | 35.16 | 48.13 | 1.48 | 1.18 | 1.16 | NA | NA |
| 079 | 0.11 | 0.57 | 0.85 | 37.79 | 46.15 | 1.35 | 0.60 | 0.59 | NA | NA |
| 080 | 0.06 | 0.08 | 0.46 | 32.80 | 53.29 | 1.17 | 0.07 | 1.10 | NA | NA |
| 081 | 0.27 | 0.11 | 0.73 | 35.58 | 47.86 | 1.18 | 0.09 | 0.49 | NA | NA |
| 082 | 0.22 | 0.04 | 0.51 | 36.11 | 48.35 | 0.93 | 0.01 | 1.06 | NA | NA |
| 083 | 0.34 | 0.57 | 1.56 | 35.73 | 51.07 | 1.40 | 0.10 | 0.77 | NA | NA |
| 084 | 0.53 | 0.34 | 1.19 | 35.90 | 46.17 | 1.35 | 0.09 | 0.81 | 0.004583 | 0.0211 |
| 085 | 0.10 | 0.04 | 0.50 | 35.48 | 49.27 | 0.97 | 0.09 | 0.41 | 0.004583 | 0.0266 |
| 086 | 0.20 | 0.32 | 1.36 | 33.99 | 49.78 | 1.18 | 0.09 | 0.77 | 0.002291 | 0.0184 |
| 087 | 0.19 | 0.07 | 0.25 | 35.16 | 49.29 | 0.92 | 0.12 | 1.07 | 0.006874 | 0.0129 |
| 088 | 0.67 | 0.10 | 0.20 | 35.14 | 49.10 | 1.00 | 0.04 | 1.06 | 0.002291 | 0.0057 |
| 089 | 0.41 | 0.22 | 0.85 | 35.52 | 49.10 | 1.07 | 0.06 | 0.54 | 0.002291 | 0.0054 |
| 090 | 0.18 | 0.17 | 0.27 | 36.58 | 46.85 | 1.35 | 0.01 | 0.71 | 0.002291 | 0.0282 |
| 091 | 0.11 | 0.07 | 1.33 | 35.50 | 49.16 | 1.00 | 0.06 | 0.80 | 0.002291 | 0.0021 |
| 092 | 0.22 | 0.08 | 0.45 | 34.56 | 49.82 | 1.37 | 0.06 | 1.13 | 0.002291 | 0.0023 |
| 093 | 0.13 | 0.06 | 0.80 | 33.86 | 48.99 | 1.03 | 0.06 | 0.92 | 0.002291 | 0.0020 |
| 094 | 0.37 | 0.13 | 0.40 | 35.18 | 49.31 | 1.45 | 0.04 | 0.83 | 0.002291 | 0.0010 |
| 095 | 0.12 | 0.03 | 0.60 | 34.77 | 49.59 | 1.18 | 0.09 | 0.77 | 0.002291 | 0.0015 |
| 096 | 0.16 | 0.10 | 0.66 | 35.56 | 49.42 | 1.48 | 0.09 | 0.83 | 0.002291 | 0.0015 |
| 097 | 0.31 | 0.06 | 0.46 | 35.71 | 48.69 | 1.22 | 0.10 | 0.90 | 0.002291 | 0.0211 |

| Sample Number | $K_2O$ | CaO | MgO | $Al_2O_3$ | $SiO_2$ | $T_iO_2$ | $Cr_2O_3$ | $Fe_2O_3$ | $P_2O_5$ | F |
|---|---|---|---|---|---|---|---|---|---|---|
| 098 | 0.11 | 0.04 | 0.17 | 35.98 | 48.93 | 0.95 | 0.09 | 1.02 | 0.002291 | 0.0103 |
| 099 | 0.13 | 0.04 | 1.16 | 35.20 | 48.61 | 1.80 | 1.05 | 0.90 | 0.002291 | 0.0203 |
| 100 | 0.14 | 0.04 | 0.40 | 34.50 | 47.81 | 0.88 | 0.04 | 0.73 | 0.002291 | 0.0136 |
| 101 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 102 | 0.23 | 1.39 | 1.04 | 35.64 | 48.33 | 1.95 | 0.03 | 1.32 | 0.002291 | 0.0204 |
| 103 | 0.34 | 0.08 | 0.12 | 35.33 | 50.02 | 1.08 | 0.01 | 1.04 | 0.002291 | 0.0183 |
| 104 | 0.30 | 0.07 | 0.43 | 35.20 | 49.03 | 1.33 | 0.13 | 1.14 | 0.002291 | 0.0116 |
| 105 | 0.34 | 0.13 | 0.61 | 35.58 | 48.90 | 1.30 | 0.07 | 1.02 | 0.002291 | 0.0168 |
| 106 | NA | NA | NA | NA | NA | NA | NA | NA | 0.002291 | 0.0138 |
| 107 | 0.18 | 0.07 | 0.65 | 35.35 | 50.89 | 1.20 | 0.13 | 0.77 | NA | NA |
| 108 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 109 | 0.54 | 0.11 | 0.58 | 34.77 | 47.21 | 0.98 | 0.03 | 1.22 | NA | NA |
| 110 | 0.28 | 0.60 | 0.91 | 35.79 | 48.52 | 0.72 | 0.06 | 0.93 | NA | NA |
| 111 | 0.22 | 0.22 | 1.09 | 33.56 | 49.57 | 1.42 | 0.03 | 0.76 | NA | NA |
| 112 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 113 | 0.33 | 0.18 | 1.23 | 36.24 | 48.18 | 1.25 | 0.09 | 0.47 | NA | NA |
| 114 | 0.13 | 0.39 | 0.63 | 34.48 | 47.88 | 1.45 | 0.03 | 0.89 | NA | NA |
| 115 | 0.33 | 0.60 | 0.88 | 34.78 | 48.71 | 1.30 | 0.01 | 0.81 | NA | NA |
| 116 | 0.30 | 1.06 | 1.19 | 35.60 | 48.78 | 1.18 | 0.06 | 1.07 | NA | NA |
| 117 | 0.34 | 0.64 | 0.99 | 35.94 | 49.25 | 1.23 | 0.92 | 8.51 | NA | NA |
| 118 | 0.31 | 0.06 | 0.41 | 35.82 | 48.24 | 1.18 | 0.06 | 2.53 | NA | NA |
| 119 | 1.06 | 0.06 | 0.86 | 35.88 | 49.01 | 1.13 | 0.06 | 1.42 | NA | NA |
| 120 | 0.30 | 0.39 | 1.19 | 36.20 | 48.22 | 2.25 | 0.12 | 1.40 | NA | NA |

# Appendix 4

## Determinations of Mineral Species Present in Each Core Using X-Ray Diffraction Techniques

Abbreviations used for Appendix 4:

S = significant amount

M = moderate amount

W = weak, or small amount

VW = very weak, or very small amount

TEM = not identified by x-ray, but identified by transmission electron microscope

| Sample Number | Mineral Composition | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kaolinite | Quartz | Anatase | Montmorillonite | Illite | Attapulgite | Halloysite | Muscovite | Dolomite | Apatite | Trace Amounts |
| 1 | S | W | W | | | | W | | | | yes |
| 2 | S | | W | W? | | | W | | | | yes |
| 3 | S | M | W | VW | M | | VW | | TEM | | yes |
| 4 | S | S | | | M | | VW | VW | | | yes |
| 5 | S | S | VW | | M | | W | | | | |
| 6 | S | M | | | | | W | | | | yes |
| 7 | S | VW | VW | | | | VW | | | | yes |
| 8 | S | S | VW | | W | | | W | | | yes |
| 9 | S | M | W | | | | | | | | yes |
| 10 | S | W | W | | | | VW | | | | yes |
| 11 | S | M | W | W? | | | VW | | | | yes |
| 12 | S | VS | W | | | | VW | W | TEM | | yes |
| 13 | S | M | W | | | | VW | | | | yes |
| 14 | S | M | W | | | | | | | | yes |
| 15 | S | S | VW | | | | | VW | | | yes |
| 16 | S | W | W | | | | | VW | TEM | | yes |
| 17 | S | W | W | VW? | | | | | | | yes |
| 18 | S | M | W | | | | W | TEM | | | yes |
| 19 | S | | | | W | | | VW | TEM | VW? | yes |
| 20 | S | S | W | | | | VW | TEM | TEM | | yes |
| 21 | S | W | W | VW | W | | | W | TEM | | yes |
| 22 | S | M | M | W | | | W | VW | | | yes |
| 23 | S | M | W | VW | W | | | TEM | | | yes |
| 24 | S | W | MW | | | | | TEM | | | yes |
| 25 | S | W | MW | W | | | | W | | | yes |
| 26 | S | W | W | | | | W | TEM | | | yes |
| 27 | S | M | W | TEM | M | | | | VW | VW? | yes |
| 28 | S | M | MW | | | | | TEM | | | yes |
| 29 | S | S | W | | | | | | | | yes |
| 30 | S | W | W | W | W | | | W | | | yes |
| 31 | S | S | W | VW | | | VW | W | | W? | yes |
| 32 | S | M | W | | W | | | W | | W? | yes |

| Sample Number | Mineral Composition | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kaolinite | Quartz | Anatase | Montmorillonite | Illite | Attapulgite | Halloysite | Muscovite | Dolomite | Apatite | Trace Amounts |
| 33 | S | S | | | W | | | TEM | | W? | yes |
| 34 | S | W | W | | | | | TEM | VW | | yes |
| 35 | S | W | VW | | W | | | | | | yes |
| 36 | S | W | W | | | | | TEM | | | yes |
| 37 | S | M | | | M | | | W | | | yes |
| 38 | S | W | VW | | | | | VW | | | yes |
| 39 | S | M | | | W | | | | | | yes |
| 40 | S | M | | | M | | | | | | yes |
| 41 | S | W | MW | | | | | W | | | yes |
| 42 | S | M | | | | | | | | | |
| 43 | S | | W | | | | | | | | yes |
| 44 | S | | W | | W | | VW | | TEM | | yes |
| 45 | S | W | W | | W | | VW | | | | yes |
| 46 | S | M | MW | | | | | TEM | | | yes |
| 47 | S | | VW | | W | | VW | | | | yes |
| 48 | S | W | VW | | | | | | | | yes |
| 49 | S | M | MW | | | | | | | | yes |
| 50 | S | M | MW | | W | | | VW | | | yes |
| 51 | S | M | MW | | | | | TEM | | | yes |
| 52 | S | W | VW | | | | | | TEM | | yes |
| 53 | S | M | W | | | | | TEM | | | yes |
| 54 | S | M | W | | | | VW | | | | yes |
| 55 | S | M | W | | W | | | W | | | yes |
| 56 | S | W | W | | W | | | W | | | yes |
| 57 | S | W | W | | | | VW | | | | yes |
| 58 | S | M | | | M? | | VW | | | | yes |
| 59 | S | M | W | | | | TEM | | | | yes |
| 60 | S | M | W | VW? | | | TEM | | | VW? | |
| 61 | S | W | W | | | | VW | | TEM | | yes |
| 62 | S | M | MW | | | | VW | | | | yes |
| 63 | S | W | | | | | VW | VW | | VW? | yes |

| Sample | Mineral Composition | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kaolinite | Quartz | Anatase | Montmorillonite | Illite | Attapulgite | Halloysite | Muscovite | Dolomite | Apatite | Trace Amounts |
| 64 | S | W | W | | | | | | | | yes |
| 65 | S | M | W | | | | | | | | yes |
| 66 | S | W | VW | | VW? | | | TEM | | | yes |
| 67 | S | S | VW | | W | | VW | W | | | yes |
| 68 | S | VS | VW | | | | | | | | yes |
| 69 | S | W | VW | | | | | TEM | | | yes |
| 70 | S | W | VW | | | | | | | | yes |
| 71 | S | W | VW | | | | VW | | | | yes |
| 72 | S | W | VW | | VW | | VW | VW | VW | VW? | yes |
| 73 | S | W | MW | | | | | | | | yes |
| 74 | S | M | VW | W | W | | | W | | | yes |
| 75 | S | M | | | | | | | | | yes |
| 76 | S | W | VW | | W | | VW | | | | yes |
| 77 | S | | VW | TEM | W | | | TEM | | | yes |
| 78-1 | S | | W | | | | | | | | yes |
| 78-2 | S | W | VW | | | | | VW | | VW? | yes |
| 78-3 | S | W | VW | | W | | | | | | yes |
| 79-1 | S | | VW | | | | VW | | | | yes |
| 79-2 | S | | | | | | | | | VW? | yes |
| 79-3 | S | W | W | | | | W | | | | yes |
| 80 | S | | VW | | VW | | | | | | yes |
| 81 | S | | W | | | | | | | | yes |
| 82 | S | | W | | | | | | | | |
| 83 | S | | MW | VW | | | | W | | | yes |
| 84 | S | | VW | | | | | | | | yes |
| 85 | S | W | W | | | | | W | | | yes |
| 86 | S | W | W | | | | | | | VW? | yes |
| 87 | S | | W | | | | | | | | yes |
| 88 | S | M | VW | | W | | | | | | yes |
| 89 | S | W | VW | | | | | | | | yes |
| 90-1 | S | | W | | | | VW | | | | yes |

| Sample | Mineral Composition | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kaolinite | Quartz | Anatase | Montmorillonite | Illite | Attapulgite | Halloysite | Muscovite | Dolomite | Apatite | Trace Amounts |
| 90-2 | S | W | | | W | | | W | | | yes |
| 91 | S | | W | | | | | W | | | yes |
| 92 | S | | VW | VW? | | | VW | VW | | | yes |
| 93 | S | | W | | | | | | | | yes |
| 94 | S | | | | | | | W | | | yes |
| 95 | S | | MW | | | | | VW | | | yes |
| 96 | S | | W | | | | | | | | yes |
| 97 | S | S | VW | VW | W | | | W | | | yes |
| 98 | S | | VW | | | | | | | | |
| 99 | S | VW | | | | | | W | | | yes |
| 100 | S | W | VW | | | | | TEM | | | yes |
| 101 | S | | VW | | | | VW | | | | yes |
| 102-1 | S | VW | MW | | | | VW | | | | yes |
| 102-2 | S | | VW | | | | | | | | yes |
| 103 | S | M | W | | | | | | | | yes |
| 104 | S | | VW | | | | | | | | yes |
| 105 | S | | W | | | | | | | | yes |
| 106 | S | W | W | | W | | TEM | TEM | | | yes |
| 107 | S | S | W | | | | | VW | | | yes |
| 108 | S | | MW | | W? | | | | | | yes |
| 109 | S | W | VW | VW | W | | | W | | | yes |
| 110 | S | W | VW | | | | | VW | | | yes |
| 111-1 | S | | W | | | | | | | | yes |
| 111-2 | S | | VW | | | | | | | | yes |
| 111-3 | S | VW | W | | | | | TEM | | | yes |
| 112-1 | S | M | W | | | | | | | | yes |
| 112-2 | S | W | W | | | | | | | | yes |
| 112-3 | S | | | | | | | VW | | | yes |
| 113 | S | | W | | | | | | | | yes |
| 114 | S | | VW | | | | | | | | yes |
| 115-1 | S | W | | | | | | | | | yes |

| Sample | Mineral Composition | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Kaolinite | Quartz | Anatase | Montmorillonite | Illite | Attapulgite | Halloysite | Muscovite | Dolomite | Apatite | Trace Amounts |
| 115-2 | S | VW | VW | | | | | | | | yes |
| 116 | S | | TEM | | | | | | | | yes |
| 117-1 | S | W | W | | | | | TEM | | | yes |
| 117-2 | S | | | VW | W | | | VW | | VW? | yes |
| 118 | S | VW | VW | | | | TEM | VW | | | yes |
| 119-1 | S | VW | W | | W | | | W | | | yes |
| 119-2 | S | VW | VW | | | | VW | | | | yes |
| 120-1 | S | | W | | | | | | | | yes |
| 120-2 | S | | | | W | | VW | | | | yes |

# Appendix 5

## Qualitative Determinations of Total Elements Present in Each Core Using Emission Spectroscopic Techniques

Abbreviations used for Appendix 5:

T = Trace

F = Faint

W = Weak

M = Medium

S = Strong

VS = Very Strong

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00001 | 00002 | 00003 | 00004 | 00005 | 00006 | 00007 | 00008 | 00009 | 00010 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | M | W | M | W | W | W | M | W | M | M |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | W | W | W | W | T | T | F | W | F |
| Mn | - | - | - | - | - | - | - | - | - | - |
| Li | T | T | - | T | - | - | T | T | - | T |
| Mg | M | W | M | M | W | M+ | M+ | W | M+ | M |
| Pb | T+ | T | T | T | F | T | W | F | F | F |
| Sn | T | T | T | - | - | F | W | T | F | T |
| Ga | F | T+ | F | F+ | T+ | F | W | F | F | F |
| W | - | - | - | ? | ? | - | F | - | F | - |
| Fe | M | M | M | M | M | W | M | W+ | W | W |
| Bi | T | T+ | - | T+ | - | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | - | T | F | F | T | T |
| V | T | W | W+ | W | W+ | F | W | W+ | W | W+ |
| Cu | W | W | W+ | W | W | W | W | F | F | W |
| Cd | - | - | - | - | - | - | - | - | - | T |
| Ag | T | - | T | T | - | - | T+ | T | - | T |
| Zn | T | F | F | - | T | T | F | F | F | F |
| Na | T | T | F | W | F | T+ | T+ | F | T | F |
| Ti | M+ | M | M+ | M | M | W | M | M+ | S | M+ |
| Ni | F | W | W | T | F | F | W | F | T | W+ |
| K | F | W | W+ | F | F | F | W | F | F | W |
| Co | T | F | F | W | F | T | F | T | - | T |
| Cr | T | F | F | T | T+ | T | F | W | F | W |
| Ca | W+ | F | F | T | T | W | F | T | T | W |
| Ba | - | T+ | T | T | T | - | - | - | - | - |
| Gd | - | - | ? | ? | ? | - | - | - | - | - |
| Zr | T | T | F+ | F+ | T | - | - | - | F | F |
| Ge | - | - | - | - | - | - | W | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00011 | 00012 | 00013 | 00014 | 00015 | 00016 | 00017 | 00018 | 00019 | 00020 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | W | F | W | F | W | M | M | F | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | T+ | T | T | T | T | T | F | T | T | T |
| Mn | T | T | - | T | - | T | W | T | T | T |
| Li | - | - | - | T | - | - | - | - | - | - |
| Mg | W | W | M | M | M | F | M | W | W | W |
| Pb | T+ | F | F | F | F | T | T | T | T | T |
| Sn | T+ | F | F | T | T | T | - | T | - | T |
| Ga | F | F | F | F+ | F | F | F | F | T | T |
| W | - | - | - | T | - | - | - | - | - | - |
| Fe | M | W | M | M | M | M | M+ | M | M | M+ |
| Bi | - | - | - | - | - | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | - | F | T | T | - | - |
| V | F | F | F | F+ | T | T | F | T+ | T | F |
| Cu | W | W | M | M | W | F | T | - | T | T |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | T | F | T | T | T | - | T | T | T | - |
| Zn | F | W | F | F | F | T | F | F | F | F |
| Na | T | T | T | T | T | T | T | - | T | - |
| Ti | M | M+ | M | M | M | W | M | M | M | M |
| Ni | F | T | F | F | T | F | F | T | F | T |
| K | F | T | F | F | T | F | F | F | T | T |
| Co | - | - | - | - | - | F | F | F | T | T |
| Cr | W | F | W | W | F | T | W | F | F | T |
| Ca | W | T | M+ | M | F | M | M+ | W | W | W |
| Ba | T | W | W | T | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | - | - | - | - | T+ | T+ | T | T | T |
| Sb | T | - | - | - | T | T | T | - | - | T |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00021 | 00022 | 00023 | 00024 | 00025 | 00026 | 00027 | 00028 | 00029 | 00030 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | W | M | M | M | T | F | W | F | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | M | M | M | M | F | W | M | M- | M+ |
| Mn | - | - | - | - | - | - | - | - | - | - |
| Li | - | - | - | - | - | - | - | - | - | - |
| Mg | MS | MS | M | M | W | M | M | MS | MS | MS |
| Pb | W | W | W | W | W | T | T | W | F | W |
| Sn | T | T | T | T | T | - | T | T | T | T |
| Ga | W+ | W | M+ | M | M | T | T | T | T | T |
| W | - | - | - | T | T | - | - | - | - | - |
| Fe | MS | MS | MS | M | MS | M | M | M | M | M |
| Bi | T | T | T | T | T | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | - | - | - | T | - | T |
| V | T | F | F | W | F | F | F | W | F | W |
| Cu | M+ | M | M | M | M+ | M | M | M | M | MS |
| Cd | - | - | - | - | - | - | - | - | T | - |
| Ag | - | - | T | T | T | - | - | T | - | T |
| Zn | F | W | W | F | W | F | - | M | F | W |
| Na | F | | | T | F | | F | T | T | F |
| Mg | MS | MS | MS | MS | MS | W | W | M | W | M |
| Ni | W+ | W | W | W | W | T | F | W | F | W |
| K | W | F | W | W | W | F | F | F | F | W |
| Co | F | T | T | T | F | - | - | - | - | - |
| Cr | W | W | W | W | W | F | F | W+ | W | F |
| Ca | W | M | W | S | W | M | M | S | S | S |
| Ba | - | - | - | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | F | F | F | F | T | - | W | F | F |
| Sb | W | T | W | W | - | - | - | - | - | - |
| Ge | - | T | T | T | T | - | - | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00031 | 00032 | 00033 | 00034 | 00035 | 00036 | 00037 | 00038 | 00039 | 00040 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | W | W+ | W+ | M | W | W | W | M | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | T | F | W | W | W | W | M | M | W | W |
| Mn | W | T | W | T | F | T | T | T | - | F |
| Li | - | - | T | T | T | - | T | T | T | - |
| Mg | M | MS | MS | MS | MS+ | M | M | M | M | M |
| Pb | T | T | F | F | F | F | F | T+ | F | T |
| Sn | - | - | T | T | F | T | - | T | T | - |
| Ga | T | F | W | W | W | W | F | F | T | W |
| W | - | F | T | - | - | - | - | T | - | - |
| Fe | M | M | M | M | M | M | M | M | M | M |
| Bi | - | T | - | T | - | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | S | S | S | VS |
| Mo | - | - | - | - | - | F | - | - | - | - |
| V | T | T | W | F | W+ | F | M | F | W | M |
| Cu | W | W | M | M | M | W | W | W | MS | W |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | F | T | F | F | T | - | - | - | - | F |
| Zn | F | T | W | W | W | T | T | T | - | - |
| Na | - | T | - | - | T | - | - | - | - | - |
| Ti | W | F | M | M | M+ | M | M | M+ | M | M |
| Ni | F | T | F | W | W | W | F | W | F | W |
| K | W | T | W | W | W | W | T | F | T | F |
| Co | F | W | W | T | F | F | - | - | - | - |
| Cr | W | F | F | F | W | F+ | F | F | T | F |
| Ca | M | M | M | M | M | F | T | T | T | F |
| Ba | F | W | M | M | M | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | F | T | W | F | W | - | - | - | - | T |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00041 | 00042 | 00043 | 00044 | 00045 | 00046 | 00047 | 00048 | 00049 | 00050 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | M | M | W | M | W | W | W | M | W | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | W | W | W | W | W | F | W | M | T |
| Mn | - | - | - | - | W | T | - | - | - | T |
| Li | T | - | T | - | - | - | T | - | F | - |
| Mg | M | M | M | M+ | S | W | M+ | W | M | MS |
| Pb | T | T | T | F | F | F | T | T | F | - |
| Sn | T | T | - | T | F | T | - | - | F | - |
| Ga | W | W | W | W | W | W | F | W | M | F |
| W | F | - | - | - | - | - | - | - | - | - |
| Fe | M | M | M+ | M+ | M | M | M+ | M | M | M |
| Bi | - | - | - | - | - | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | - | - | - | - | T | - |
| V | W | W | W | W | W | W | F | F | W | F |
| Cu | M | M+ | M | M+ | M | M | M | M | M | F |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | - | T | - | - | - | - | - | - | T | - |
| Zn | T | T | - | T | W | T | - | - | T | T |
| Na | - | T | T | T | T | - | - | - | - | - |
| Ti | M | M | M+ | M | M | M | M | M | M | W |
| Ni | W | W | W | M | W | W | W | F | M | T |
| K | F | F | F | W | W | T | T | W | W | T |
| Co | - | - | - | - | F | - | - | - | - | - |
| Cr | W | F | T | F | M | - | T | T | W | T |
| Ca | T | F | F | W | S | - | - | F | F | W |
| Ba | - | - | - | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | - | - | - | - | F | - | T | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00051 | 00052 | 00053 | 00054 | 00055 | 00056 | 00057 | 00058 | 00059 | 00060 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | W | W | W | F | F | M | W | F | M |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | W | F | W | W | F | W | M | F | F |
| Mn | T | - | - | T | F | T | T | - | - | - |
| Li | F | - | - | - | - | - | - | F | - | - |
| Mg | M | M | M | W | M | S | M | M | W | M |
| Pb | F | - | - | F | T | F | T | T | - | T |
| Sn | F | - | T | T | - | F | T | T | - | - |
| Ga | W | W | F | F | T | F | W | W | F | F |
| W | - | - | - | - | T | - | - | T | - | - |
| Fe | M | M | M | M | M | M | M | M | M | M |
| Bi | - | - | - | - | - | - | - | T | - | - |
| Al | VS | VS | VS | VS- | VS | VS | VS | VS | VS | VS |
| Mo | T | - | - | - | - | T | - | - | - | - |
| V | W | F | F | T | T | F | F | W | F | T |
| Cu | M | M | M | M | F | M | MS | M | W | M |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | - | - | - | T | - | - | - | - | T | - |
| Zn | T | - | - | T | F | F | - | T | - | T |
| Na | T | - | - | - | T | T | - | - | - | - |
| Ti | M+ | M | M | M | M | MS | M | M | M | M |
| Ni | W | W | F | W | F | F | F | F | T | F |
| K | T | F | T | F | F | F | F | F | F | T |
| Co | - | - | - | - | - | - | - | - | - | T |
| Cr | F | - | T | F | F | W | - | W | - | - |
| Ca | F | T | T | W | M | M | T | T | T | W |
| Ba | T | - | - | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | - | - | T | - | F | - | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00061 | 00062 | 00063 | 00064 | 00065 | 00066 | 00067 | 00068 | 00069 | 00070 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | M | F | F | M | M | M | F | F | W | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | T | T | W | W | T | M | W | W | W |
| Mn | - | - | T | - | T | - | - | T | T | - |
| Li | - | - | - | - | T | - | - | - | - | - |
| Mg | M | M | M | M | M | M | M | M | M | M+ |
| Pb | F | - | - | F | T | - | T | T | F | T |
| Sn | - | - | - | T | - | - | - | - | - | - |
| Ga | W | T | F | W | F | F | F | F | W | F |
| W | - | - | - | - | F | - | - | - | - | - |
| Fe | M | M | M | M | M | M | M | M | M | M |
| Bi | - | - | - | - | - | T | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | S |
| Mo | - | - | - | T | T | - | - | - | - | - |
| V | W | F | T | F | W | F | W | T | W | F |
| Cu | M | W | W | M | M+ | W | W | M | M | W |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | T | - | T | - | - | - | T | F | T | - |
| Zn | T | T | - | T | T | T | - | T | - | - |
| Na | - | - | - | T | - | - | - | - | - | - |
| Ti | M | M | W | M | M | M | M | M+ | M | M+ |
| Ni | F | - | F | F | T | - | W | W | F | F |
| K | T | F | T | T | T | F | F | F | F | T |
| Co | T | T | - | T | F | T | - | - | - | - |
| Cr | F | F | T | F | T | F | F | W | - | T |
| Ca | F | M | W | T | F | M | T | M+ | F | W |
| Ba | T | - | - | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | T | - | T | - | T | T | T+ | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00071 | 00072 | 00073 | 00074 | 00075 | 00076 | 00077 | 00080 | 00081 | 00082 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | M | F | F | F | W | W | W | M | F |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | M | F | W | W | W | W | F | M | W |
| Mn | T | T | T | W | W | F | F | T | - | - |
| Li | - | T | - | - | F | T | T | - | T | - |
| Mg | M+ | MS | MS | M+ | MS | M | M | M | M | W |
| Pb | - | W | T | T | F | F | F | T | - | T |
| Sn | - | T | - | - | T | - | T | - | - | - |
| Ga | W | W | W | F | W | W | M | F | W+ | F |
| W | - | T | - | T | - | - | - | - | - | - |
| Fe | W | M+ | M | M | MS | MS | MS | MS | M | M |
| Bi | - | - | - | - | - | - | - | - | - | - |
| Al | VS | S | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | T | T | T | - | T | - |
| V | F | M+ | T | F | W | W | W | F | W | T+ |
| Cu | W | M | W | W | M | M | M | M | W | W |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | T | - | - | T | - | - | - | - | - | - |
| Zn | - | T | W | T | F | T | T | T | - | - |
| Na | - | - | - | T | - | T | T | - | - | - |
| Ti | M | M | M | M | M | M | M | M | M | M |
| Ni | W | M | F | W | F | M | M | F | T | F |
| K | F | W | F | F | F | W | W | F | T | F |
| Co | - | T | - | - | - | T | T | T | - | - |
| Cr | T | W | T | W | W | W | W | T | F | T |
| Ca | M | W | M | M+ | S | W | F | T | T | T |
| Ba | - | - | - | - | - | W | W | W | - | W |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | - | - | F | F | T | - | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00083 | 00084 | 00085 | 00086 | 00087 | 00088 | 00089 | 00090 | 00091 | 00092 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | M | M | M | M | M | M | M | F | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Fe | W | F | W | W | W | W | F | W | W | F |
| Mn | - | - | - | - | - | - | - | - | - | - |
| Li | - | T | T | T | T | T | | F | - | T |
| Mg | S | M | M | M+ | M | W | F | M+ | F | W |
| Pb | - | T | T | F | T | T | - | W | - | T |
| Sn | - | T | T | T | F | T | - | F | - | T |
| Ga | F | W+ | W | M | M | W | W | M | F | W |
| W | - | - | - | W | T | - | - | - | - | - |
| Fe | M | MS | M | M+ | M | MS | W | MS | M | MS |
| Bi | - | - | - | T | - | - | - | T | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | T | - | - | - | T | - | - |
| V | W | W | M | M | M | F | F | M | W | W |
| Cu | W | M | M | M | M | M | W | M+ | M | M |
| Cd | - | - | - | - | - | - | - | - | - | - |
| Ag | - | - | - | - | T | - | - | F | - | - |
| Zn | - | - | - | T | T | - | - | W | - | T |
| Na | - | - | T | - | T | - | - | F | - | F |
| Ti | M | T | M | M | M | M | M | MS | - | M |
| Ni | F | M | W | W | W | W | T | M | M | M |
| K | T | W | F | T | F | W | T | W | F | W |
| Co | - | - | - | - | T | - | - | T | F | T |
| Cr | F | F | M | M | M | T | T | M | F | M |
| Ca | M | F | - | F | F | F | T | W | T | MS |
| Ba | - | - | - | - | - | - | - | - | T | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | - | T | - | - | - | - | - | - | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00093 | 00094 | 00095 | 00096 | 00097 | 00098 | 00099 | 00100 | 00103 | 00104 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | W | W | W | W | W | W | W | W | M | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | W | W | W | W | W | W- | W | F | W | W |
| Mn | - | - | - | - | - | T | - | - | - | - |
| Li | - | T | - | T | T | - | - | F | - | - |
| Mg | W | W+ | W | W | MS | W | W | F | W | W |
| Pb | T | T | - | T | F | - | F | F | - | T |
| Sn | - | T | T | - | F | - | T | T | - | - |
| Ga | W | W | W | W | M | W | W+ | M | F | W |
| W | - | T | - | - | W | - | - | - | - | - |
| Fe | M | M | M | M | MS | M | M | M | M | M+ |
| Bi | - | - | - | - | T | - | - | - | - | - |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | T | - | - | - | - | - | - | - | - |
| V | F | M | W+ | W | M | W | W | F | T | W |
| Cu | W | M | W | M | M | M | MS | M | M | M |
| Cd | - | - | - | - | - | T | - | - | - | - |
| Ag | - | - | - | - | - | - | T | - | - | - |
| Zn | - | T | - | - | T | - | - | T | - | T |
| Na | - | T | - | - | - | - | F | T | - | - |
| Ti | M | M | M | M | M | MS | M | M | M | M |
| Ni | W | W | F | M | W | F | M | W | W | W |
| K | F | F | F | F | F | T | W | F | T | F |
| Co | - | T | - | - | - | T | T | T | - | - |
| Cr | W | W | W | W | M | F | F | F | T | F |
| Ca | T | T | W | T | T | T | W | F | T | F |
| Ba | - | W | - | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | - | - | - | - | - | - | - | T | - | - |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 00105 | 00106 | 00107 | 00108 | 00109 | 00113 | 00116 | 00118 | 10090 | 10111 |
|---|---|---|---|---|---|---|---|---|---|---|
| B | M | F | W | F | W | F | F | F | W | W |
| Si | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| P | M | W | F | M | M | F | W | W | W | F |
| Mn | - | W+ | - | W | - | - | T | - | F | - |
| Li | - | - | - | - | - | T | - | - | T | T |
| Mg | M | M | F | W | W | W | M | M | M | W |
| Pb | F | F | T | F | T | F | F | T | F | T |
| Sn | T | - | - | T | - | F | - | T | F | F |
| Ga | W | W | F | M | W | M | W | F | M | M |
| W | - | - | F | - | - | - | - | - | - | - |
| Fe | MS | M | M | M | M | M | MS | MS | M | M |
| Bi | - | - | - | T | - | - | - | - | - | F |
| Al | VS | VS | VS | VS | VS | VS | VS | VS | VS | VS |
| Mo | - | - | - | - | - | T | T+ | - | F | - |
| V | W | F | W | F | W | W | W | M | W | T |
| Cu | M | M | W | M | M | M | M | M | M | M |
| Cd | - | - | - | T | - | - | - | - | - | - |
| Ag | - | - | - | - | - | - | - | - | T | T |
| Zn | - | - | - | - | T | F | T | T | W | - |
| Na | T | T | - | T± | - | W | T+ | T | T | T |
| Ti | M | W | M | W | M | M | M | M | S | W |
| Ni | W | W | T | W | W | W | M | W | M | W |
| K | W | W | F | W | F | W | W | F | M | W |
| Co | - | T | - | - | T | - | - | F | - | T |
| Cr | F | F | F | W | F | F | M | M | M | F |
| Ca | F | M+ | F | M | T | F | MS | M | S | F |
| Ba | - | - | T | - | - | - | - | - | - | - |
| Gd | - | - | - | - | - | - | - | - | - | - |
| Zr | T | - | - | - | - | - | - | F | - | T |

## DATA SHEET

EMISSION SPECTROSCOPY

| | 10117 | 10119 | 10120 | 20117 | 20119 | 20120 | 30111 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| B | M | T | W | W | T | F | F | | | |
| Si | VS | VS | VS | VS | VS | VS | VS | | | |
| P | M | F | M | MS | W | M | W | | | |
| Mn | F | - | W+ | - | - | W+ | - | | | |
| Li | T | - | T | - | - | - | T | | | |
| Mg | M | M | S | M | M | M | W | | | |
| Pb | T | W | W | W | F | F | T | | | |
| Sn | - | W | F | F | - | T | T | | | |
| Ga | M | W | M | W | F | W | W+ | | | |
| W | - | - | - | T | - | - | - | | | |
| Fe | S | M | M+ | S | S | M | M | | | |
| Bi | - | T | - | - | - | - | - | | | |
| Al | VS | VS | VS | VS | VS | VS | VS | | | |
| Mo | T | - | T | - | - | T | - | | | |
| V | M | W | M | W | W | F | W | | | |
| Cu | M | M+ | M | M | M+ | M | M+ | | | |
| Cd | - | - | - | - | - | - | - | | | |
| Ag | - | - | T | - | - | - | T | | | |
| Zn | F | T | F | - | - | F | F | | | |
| Na | T | F | T | - | T | F | F | | | |
| Ti | M | M | M | M | M | M | M | | | |
| Ni | M | W | W | W | W | W | M | | | |
| K | W | W | W | F | F | F | W | | | |
| Co | F | T | T | F | W | T | T | | | |
| Cr | MS | W | M | - | W | W+ | F | | | |
| Ca | MS | M | M+ | T | M | MS | W | | | |
| Ba | - | - | T | - | - | - | - | | | |
| Gd | - | - | - | - | - | - | - | | | |
| Zr | - | - | W | - | - | - | - | | | |
| As | - | - | - | T | - | - | - | | | |